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AUGUST 1902

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Regents Bulletin

No. 58

40th University Convocation

OF THE

State of New York, June 30–July 1, 1902

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1913

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University of the State of New York

New York State Library

MELVIL DEWEY Director

Bulletin 75

LIBRARY SCHOOL 12

LECTURE OUTLINES AND PROBLEMS

PREFACE

This bulletin is made up mainly of new editions of miscellaneous lecture outlines and problems originally issued separately for use of the State Library School. The syllabus on American Library Association presidents is printed for the first time. To provide for dissecting and filing by subject the material relating to each course begins on a separate leaf.

MELVIL DEWEY
Director

Albany, Sep. 1, 1902

010 BIBLIOGRAPHY

DIRECTIONS FOR ORIGINAL BIBLIOGRAPHY

Salome Cutler Fairchild

For sufficient reason the vice director will give permission for variation from these rules, but the rules so amended must be followed uniformly.

Subject. The original bibliography may be:

1 A complete bibliography of a subject
2 " " an author
3 A select " a subject
4 A reading list with notes

A complete bibliography must indicate the best books from both scholarly and popular standpoints. A reading list must contain notes indicating scope and value of works.

A subject must be selected and approved by Feb. 1 of junior year. The bibliography must be submitted on or before June 1 of senior year.

Choose a subject in which you are interested. If you have no decided preference, consult the vice director.

Submit the subject to the vice director, who with the lecturer on bibliography, will determine scope and suggest treatment.

Be thorough, be accurate, be consistent.

Material. Do not be satisfied with the resources of one library, but, as far as feasible, work in other libraries. Be always on the alert for material. Help each other by reporting out of the way references.

If possible, examine all works included in your list. Indicate by e books personally examined, using e (underlined) if the edition examined is not the same as that entered in the list. Give call numbers of books in the New York State Library, even when editions differ from those described in the list: e. g. E914.7 H21; for books in the Home Education Department give class number only. Cite libraries in which books not in the State Library were seen, thus: Vassar e.

Prefix lists of all but obvious abbreviations used and of principal bibliographic aids consulted.

In analytic work make a list of "Works cited," to include full entries of all books from which more than one analytic has been taken (*see* Analytics). To any of these that are analyzed add a note specifying edition analyzed if different from that in the list; e. g. "Analyzed, Houghton, 1870."

For form of prefatory matter see *N. Y. State Library Bibliography 32.*

In all cases of doubt or lack of specific directions give too much rather than too little information.

Form of citation

Use *Library School Rules*, following general directions below.

Author and title. In complete bibliography give names with
fulness and full titles. Consult not only the name (author) cat
but also recent publications for later biographic data or fuller
Be sure that an author's name is in the same form throughout t
Use subject fulness according to cataloguing rules (see *N. Y*
Library Bibliography 32), in title and in notes and indexes. In
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name, for which the *Catalog of "A. L. A." Library* will serve as a
As a rule give brief title, but always include alternative title, n
editor or translator, and any part of title that will add to value of
or show reason (not otherwise plain) for its inclusion; e. g. name
trator of children's books, author of prefatory or other additional
and even minor information if needed to distinguish editions.

Edition. In complete bibliography arrange editions chronolo
and distinguish with as complete information as possible; see *N. Y*
Library Bibliography 17, p. 544. In reading list or select biblio
choose one edition, except for unusual reasons, and put refere
others in a note; e. g. "Published without illustrations and in
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Foreign money

igns and abbreviations		NAME	Approximate value
recedes	Follows		
£		pound	$4.87
	c	centime	⅕
ent.		centesimo	⅕
	ct	cent (Dutch)	⅖
	d	penny	.02
or fl)		gulden (guilder; Dutch florin)	.40
	fl	florin (gulden; Austrian)	.49
	fr	franc	.19
	gr (or gl)	groschen	.02⅓
		heller (Austrian)	¼
	kr	krona (Swedish)	.27
	kr	krone (Austrian)	.20
	kr	" (Danish and Norwegian)	.27
	kr	kreutzer (Austrian)	½
	kr	" (German)	⅔
l		lira	.19
	m	mark	.24
	ngr (or ngl)	neugroschen	.02½
		öre	¼
		peseta; pl. pesetas	.19
	pf	pfennig	¼
		rigsdaler	.54
	s	shilling	.24
	sk	skilling (Norwegian)	.01
	sk	" (Danish)	½
	spd	specie daler	.91
	st	stuiver	.02
	thlr	thaler	.72

Series. Abbreviate as in *N. Y. State Library Manuscript List of Series*. Note the following illustrations:

(Eng. classics; star ser.)　(Lib. of economics and politics, v. 7)
(Riverside lit. ser. no. 86)　(Amer. sci. ser. advanced course)

Analytics in books. When but one analytic is cited give in usual form, and place imprint information in note. When more than one, place complete entry in list of "Works cited" and analytics in usual form in their proper places. If two or more analytics with same author and from the same book are to be entered under same heading make full entry of book, or brief entry (as below) if full entry is made under "Works cited," and give titles and paging of analytics in note; e. g.

Gladden, Washington. Social Facts and Forces. 1897. 304 G45
　The Corporation, p. 82–115
　The Railway, p. 116–54

If the edition analyzed differs from that cited, indicate edition. When the part of a book referred to has no definite title, supply an appropriate title and inclose it in brackets.

Note the following illustrations:

(*see his* Writings. 1891. p. 9–195)
(*see* Reminiscences of the City of New York. 1855. p. 145–47)
(*see* Shaler, N. S. The United States of America. 1897. 2:191–213)

Analytics in serials. Do not call a periodical article anonymous if the author's name appears in connection with the article anywhere in the periodical. Use abbreviations for periodicals given in *N. Y. State Library Manuscript List of Periodicals;* for all others use full form. Use the following forms for months:

Jan.　Ap.　July　Oct.
Feb.　May　Aug.　Nov.
Mar.　June　Sep.　Dec.

Note the following illustrations:

(*see* Century Mag. May 1883, 4:96–114)
(*see* Overland Mo. Aug. 1899, ser. 2, 34:120–22)
(*see* Jour. of Educ. (Boston) Sep. 15, 1892, 36:168)
(*see* Pennsylvania Mag. of Hist. and Biog. 1878, v. 2, no. 3:296–302)
(*see* U. S.—Education, Bureau of. Report, 1890–91. 2:676–783)
(*see* Amer. Econ. Ass'n. Economic Studies, Ap. 1896, 1:305–7)
(*see* National Educ. Ass'n. Proc. 1890. p. 547–54)

For arrangement of numerous references to the same periodical under one entry see *N. Y. State Library Bibliography 24*, p. 428–29, and *31*, p. 16^7, 26^2.

Contents, notes. Use the following order: notice of different edition, publisher or price; contents; compiler's critical or descriptive note; quoted note; origin or other forms of material (address, paper, argument, reprint, pamphlet, magazine article, etc.); references to reviews, criticisms or summaries.

For arrangement of contents see *N. Y. State Library Bibliography 24, 32.*

Quoted notes may be condensed but great care should be taken not to alter meaning. Give exact references, using the following forms:

— Nation, Feb. 27, 1868, 6: 170–72 (i. e. title, date, volume, pages)
— N. Y. State Trav. Lib. Finding List 7, p. 3
— Fiske. Beginnings of New England. 1889. p. 280

If the same book is frequently quoted, enter it in the list of abbreviations and use short form at end of note; e. g. Adams, p. 386, for Adams, C: K. Manual of Historical Literature. 1891. p. 386. In citing periodicals as authority use abbreviated forms in the *N. Y. State Library Manuscript List of Periodicals.*

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Submit reading list on 20x25 cm thesis paper, complete bibliography on 7½x12½ cm slips or cards, and select bibliography on either slips, cards or thesis paper according to the subject. Folded thesis paper in quires of four sheets is best for permanent binding.

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021, 023-024 FOUNDING AND GOVERNMENT

023.4 QUALIFICATIONS OF A LIBRARIAN

Melvil Dewey

As a man. Character

Fiber, inborn qualities

"Every man is as God made him and ofttimes a good deal worse." You can polish an agate, but not a pumpkin.

Spirit of work

a Aspiration for excellence, for higher things, not mere ambition ("going round for votes") but constant struggle against tendency to sag. Every soul like every drop of water, is pulled steadily toward the lowest point by gravity. No boat ever drifts upstream when the oars stop. He who aspires to the best must never wholly relax earnest effort.

> Heaven is not reached by a single bound;
> But we build the ladder by which we rise
> From the lowly earth to the vaulted skies,
> And we climb to its summit,
> Round by round. *J. G. Holland*

b Courage (active) is brave to do, e. g. to lead cavalry charge; "heart in." Fortitude (passive) is brave to suffer and endure.

c Enthusiasm; love; zeal; "soul in," "God in"; earnestness; inspiration.

d Energy; force; "work in."

e Patient persistence; steadfast purpose. Too great haste will make an ugly scar from a seal suddenly struck on wax, when patient pressure will give an impression as clear cut as a cameo. The world is afloat and lazy and can be moved by patient pushing. A heavy blow on a loaded canal boat will cause only a tremor. Half the force patiently applied will move it to the other shore. Illustrations: Kipling; "crabs don't let go"; mushrooms v. oaks.

"Time is of the essence of the contract."

"For the right moment you must wait most patiently as Fabius did when warring against Hannibal, though many censured his delays. But when the right moment comes you must strike hard, else your waiting will have been in vain and fruitless."

Motto of Fabian Society

f Faith; optimism. Self-confidence, but not overconfidence. Believe in yourself and your work. "Hitch your wagon to a star."

Emerson

g Unselfishness. The ideal rule of life is to do anything, anywhere, at any time, that sober judgment says will do the greatest good to one's fellows.

The ideal of these essential qualities is like the best literary style and the best window glass: i. e. that which is not noticed and causes no remark. Overdressing, affectation or undue "ease of manner" is as objectionable as the opposite fault.

Physical qualities. Health; strength; endurance; trained powers. See 7. Body is machine through which work must be done. Unless it is properly cared for the best work is as impossible as to win a race with an overtired horse.

Health modifies (helps or harms) temper, tact and most other qualities. It is a vehicle for them like water for giving medicine. Greatest dangers are overwork, too long hours, too short vacations, too little sleep. Greatest needs are regular habits, intelligent diet, and exercise by walking, cycling, dumb-bells, movements, rubbing, flexing, etc.

Mental qualities

a Orderly habit. A misplaced book or pamphlet is a needle lost in a haystack. Some professions admit lack of order, but not the librarian's. A ditch-digger may smoke, but not an employee of a fireworks factory.

b Memory. Less essential but very important. Library memory may be largely cultivated.

c Accuracy. Invaluable but must not be at sacrifice of speed.

d Speed; dispatch; prompt decision; readiness. Expert riflemen and billiard players take quickest aim. Fastest stenographers are often most accurate. Quickness may be cultivated. Tennis is admirable discipline in prompt decision. Preparing copy for daily paper trains to completion of work at specified time. After dinner speeches without previous warning train quick wits. "Reading maketh a full man, writing an exact man, and conference a ready man." Accuracy and speed must be equally developed to get best results. Quality and quantity must be multiplied together like length and breadth to get efficiency or area. A perimeter gives the maximum area only when evenly divided. If perimeter is 40, each side may be 10 and the area 100. If sides are unequally divided 15x5 equals 75, 19x1 equals 19. Efficiency depends on product of accuracy and speed, or quantity and quality, as much as momentum or impact depends on mass multiplied by velocity.

Conciseness helps speed. Telegram written like polite note shows a frank or folly. Gotten (got 10) seats.

e Executive ability; power to organize and delegate work, to marshal and use four m's which produce results: i. e. materials, machinery (tools, labor-saving devices), methods, men. Without this can get only maximum wages for individual. With it you get pay for what others do. This is unjust no more than to take pay history and literature. As library covers entire field of knowledge which no man could master, the librarian's training should be not to accumulate facts, but to know where and how to get any facts promptly when wanted. Don't buy fish which will soon cease to be fresh, but poles, lines, hooks and bait and learn holes where they may be quickly caught when wanted. Librarian like guidepost is always pointing the way for others instead of going himself.

a Sociology. Public press and university are all making sociology prominent. This is sociologic century. 19th was scientific, 18th was theologic. After German and French, which are working tools, no subject is more useful to a librarian than sociology.

b Useful arts. Some general knowledge is valuable in the growing work of helping mechanics and artisans in their own field.

As a bibliographer

Knowledge of books. Appreciation, not creation

Physical (outside)

a Printers' and publishers' work. In print the great aim should be to convey the author's meaning to the reader's mind clearly, in the quickest and easiest way. Omit everything not needed for this end.

(1) Paper. Color, thickness, durability, cost.

(2) Printing. Size and face of type, leading, spacing, length of line, margins, ink, presswork, mechanical proof reading, cost.

(3) Binding. Materials, methods, cost, durability, color, convenience in handling.

Intellectual (inside)

b Editor's work. Contents, indexes, footnotes, editorial proof reading and verification.

c Author's work. Style, facts, accuracy; i. e. subject-matter.

d Bibliographer's work. Organized and comparative bibliography; knowledge of editions, publishers, prices and comparative merits and faults of *a*, *b* and *c*. Catalogues, selections, annotations, evaluations, "filtrations." Object to select for reader the book that then, there and to him is most useful.

As a library economist

1 Knowledge of library systems and methods

a Scope and founding of libraries.

b Legislation, local, state, national.

c How to raise money.

d Connection with schools.

e Reading of the young, children's libraries.

f Buildings and equipment.

- *g* Library assistants.
- *h* Salaries, hours, vacations, etc.
- *i* Accession department (all methods of getting books).
- *j* Preservation of books.
- *k* Use of books, for reference and in lending. Get, keep, use—the greatest of these is use.
- *l* Cataloguing and classification.

12 Library experience. For best results, must combine knowledge and experience (like quantity and quality or speed and accuracy). Physician must add hospital work to graduation and M.D. before he is fully trusted.

13 Knowledge and experience

- *a* in business principles and methods.
- *b* of the world at large (travel).
- *c* in special accomplishments; mechanical ability. Value not intrinsic, but for convenience in trifling needs; desirable but not essential. Some great mathematicians can't add or multiply accurately, but must use machine or clerk.
  - (1) Book repairing } Of greatest practical value in saving time and
  - (2) Book gilding } cost of sending away to bindery.
  - (3) Handwriting, lettering. Very useful for bulletins, notices, etc. Easily learned.
  - (4) Notehand. Learned in an hour and saves quarter of labor without appreciably affecting legibility for one's own use. Also readily learned and used by regular correspondents. Should be used by all who do not learn shorthand.
  - (5) Shorthand. Invaluable labor-saver, but useless unless well learned. To begin and stop for a time is like taking long rests when rowing boat up strong current; you may float back farther than you have rowed. Most systems too complicated for anyone except professional stenographer. Tachygraphy is easily learned and best for librarian's use.
  - (6) Typewriting. More legible, quicker, cheaper and easier, so should be used personally as well as by assistants and copyists.
  - (7) Duplicating processes. Stencil, carbon, roller copier, composition and aniline.
  - (8) Labor-saving methods and appliances.

14 Efficiency. Total or resultant of all foregoing factors. World wants results, not explanations (however good) of failure. The best men compel success and remove obstacles. Cheaper men explain clearly why success was impossible. They may be clever, clear-headed, honest, industrious, but not efficient in high sense that compels success.

025.2 ACCESSION DEPARTMENT

AUCTION CATALOGUE: PROBLEM

Dunkin Van Rensselaer Johnston

Look up information to guide in making bids on the following books. Numbers at beginning of entries are those of auction catalogue from which they are taken and entries are quoted without change.

2 **Adams.** The Swiss confederation. By Sir Francis Ottiwell Adams, M.C.M., G.C.B., late Her Majesty's Envoy extraordinary and minister plenipotentiary at Berne, and C. D. Cunningham. With a map. 8vo, uncut. 1889

0 **Ariosto.** Orlando Furioso. Italian text beautifully printed by Baskerville; with portrait after Titian engraved by Piquet, and 46 copper-plates by Bartollozzi, Moreau, De Launay, etc. after designs by Cipriani, Eisen, Cochin, Moreau and Monnet. 4 vols., tall 8vo, half red morocco, gilt. Birmingham, 1773

3 **Art and letters:** an illustrated review. Published in London and New York. Richly illustrated with colored reproductions, etchings and photogravures of the choicest modern paintings. Published at $6.00 per no. Complete for the years 1888 and 1889, in 24 nos. To be sold per number.

1 **Austin, Jane.** Life of. By Goldwin Smith. 8vo, cloth. Great writers series. London, 1890

5 **Baker, A. E.** Glossary of Northamptonshire, Words and phrases, with examples of their colloquial use and customs of the country. 2 vols. 12mo, uncut. London, 1854

37 **Baptista (El Padre Fray Ioan).** Advertencias, para los confessores de los naturales. Both parts. 2 vols. small 8vo, vellum. Mexico, en el Conuento de Santiago Tlatilulco, par M. Ocharte, eno 1600

Excessively rare. The Murphy copy, the two parts of which were separated by the compiler of that catalogue, sold: part 1, (with another work bound with it) for $46.00; part 2, for $38.00: sold, Maissonneuve, 1861; for 301 fr. This copy lacks the title-page to the second part, it being replaced by a duplicate first part title-page; the 15 preliminary leaves are bound in before the body of the second part. Slight worm-holes in blank corner of a few leaves.

51 **Bewick.** Select fables. With cuts designed and engraved by Thomas and John Bewick, and others, previous to the year 1784; splendid impressions of the cuts. Imp. 8vo, full polished calf, uncut, gilt top. Newcastle, 1820

57 **Boating.** Training in theory and practice. By Archibald Maclaren. Illustrated. 8vo, cloth. London, 1866

0 **Hosack, David, M.D., F.R.S.** Memoir of De Witt Clinton. With an appendix. Portrait and two extra portraits inserted. Also contains an A.L.S. of Dr Hosack and an A.L.S. "To the public" of Gov. Clinton, of great interest, in part as follows: "General Scott ....having in a letter.....to General Jackson insinuated that I had written.....an anonymous letter......I have considered it proper to declare that the intimation of General Scott is totally... false....This declaration is made from motives of respect for public opinion and not from any regard for General Scott.....(one page, quarto, dated April 6, 1819). 1 vol. 4to, boards. New York, 1829

0 **Jesse, Captain W.** The life of George Brummel, Esq., commonly called Beau Brummel. Frontispieces. 2 vols. 8vo, rough edges, half green morocco, gilt top, new. London, 1844

Original edition. Scarce.

0 **Lessing's Werke.** 10 vols. in 5. Post 8vo, half morocco. Leipzig, 1867

3 **Lowell, J. R.** A fable for critics. 12mo. New York, 1848

First edition.

36 **Matthews, B.** (Editor). Ballads of books. With frontispiece by Van Schaick. 12mo, full polished calf, uncut, gilt top. New York: Coombes, 1887

2 **Napoleon.**—Jung, Th. Bonaparte et Son Temps, 1769–1799. Avec cartes. 3 vols. 12mo, paper, uncut. Paris, 1881

8 **New York.** The centennial history of the protestant episcopal church in the diocese of New York, 1785–1885. Edited by James Grant Wilson. 7 steel plates, 4 woodcuts, and 27 autograph facsimiles. 8vo, uncut. New York, 1886

0 **Nile's Weekly Register**: containing political, historical, geographical, scientifical, astronomical, statistical and biographical documents, essays and facts, with notices of the arts and manufactures and a record of the events of the times. A COMPLETE SET, from the commencement in 1811 to the end of June, 1849, when it was finally discontinued; containing all the supplements and appendixes, with the rare index volume of 1818, and with Niles's "Principles and acts of the revolution," 1822. Together 77 vols. 8vo, and 4to, the former uniformly bound in half russia, cloth sides, the latter in half sheep. 1811–1849

A very fine and desirable set.

0 **Freytag.** Lexicon Arabicum Latinum. Condensed from the larger work. Halle, 1836

1 **Pamphlets** on slavery: Spooner on its unconstitutionality, 1856; De Vinne on the Methodist episcopal church and slavery, 1857; *American slavery as it is*, 1830. 1 vol. 8vo, half morocco.

025.3 ELEMENTARY CATALOGUING

USE OF CARD CATALOGUE: PROBLEM

Mary Louisa Sutliff

Answer the following questions by consulting the card catalogue]of the New York State Library. Work independently. Write the answers on sheets, referring to questions by number.

1 What works of Annie Payson Call have we?
2 Have we any works of S: R. Crockett aside from fiction?
3 Have we Shakspere's works in one volume with illustrations?
4 Have we an edition of the *Tempest* with notes?
5 Have we Francis Bacon's poems as a separate publication?

Who are the authors of the following four books?

6 *The Garden that I Love*
7 *High Top Sweeting*
8 *Highways and Horses*
9 *My Three Legged Story Teller*
10 What works edited by George E. Woodberry have we?
11 Have we Arthur Gilman's edition of Chaucer's *Poetical Works?*
12 Have we the fifth edition of *How to Know the Wild Flowers*, by Mrs William Starr Dana?
13 What work written by Mark Twain in collaboration with C: D. Warner have we?
14 How many of Clara Bell's translations have we?
15 Have we Charles Gross's translation of Ernest Lavisse's *General View of the Political History of Europe?*
16 What translations of the *Nibelungenlied* have we?
17 What lives of Sir Matthew Hale have we?
18 What bibliographies of Alexander Hamilton have we?
19 Have we Richard H. Shepherd's *Bibliography of Carlyle?*
20 Have we a criticism of John Stuart Mill's *Subjection of Women?*
21 How many volumes of the *Great Cities of the Republic* series have we?

Give author and title of any book which the library contains on the following five subjects:

2 Object teaching
3 Mechanics, published since 1890
4 Travel in China
5 General history of France, with maps
6 French Revolution, in two volumes

7 Give compiler and title of a bibliography of kindergarten
8 Give author and title of work containing lives of several sculptors
9 Name five sculptors whose lives are to be found in the library
0 Give titles of two anonymous English poems of the pre-Elizabethan period, 1400–1558

025.5 ADVANCED REFERENCE WORK

016.34 LAW BOOKS DESIRABLE FOR TOWN, VILLAGE AND CITY LIBRARIES

Stephen B. Griswold

ouvier, John. Law Dictionary; new ed. rev. and brought up to date by Francis Rawle. 2v. Q. Bost. 1897. Boston Book Co. $12 Law library

ent, James. Commentaries on American Law. Ed. 14. 4v. O. Bost. 1896. Little $3.50 net each Law library

arsons, Theophilus. Laws of Business for all the States and Territories of the Union and the Dominion of Canada, with forms and directions, and abstracts of the laws of all the states and territories on various topics. New ed. 864p. O. Hartford 1890. S. S. Scranton & Co. $4.50 Law library

ones, Leonard Augustus. Forms in Conveyancing; comprising precedents for ordinary use and clauses adapted to special and unusual cases. Ed. 5. 956p. O. Indianapolis 1899. Bowen-Merrill $6

Law library has ed. 4, 1894.

odgers, William Champ. Treatise on the Law of Domestic Relations. 900p. O. Chic. 1899. T. H. Flood $6 Law library

ill, Frederick Trevor. Care of Estates. 176p. D. N. Y. 1901. Baker, V. & Co. $1.25 Law library

ubbell's Legal Directory. O. N. Y. Hubbell Publishing Co. $5 Law library

Annual.

If library can afford more, buy:

merican and English Encyclopaedia of Law; ed. by D: S. Garland and L. P. McGehee under the supervision of James Cockcroft. Ed.2. v.1–21, Q. Northport N. Y. 1896–1902. Edward Thompson Co. $7.50 each Law library

v. 1–21 A—N. Probably complete in 32v.

test edition of the Revised Statutes and Codes of the state in which the library is situated, with the Session Laws in continuation; Revised Statutes and Codes $6 to $18; Session Laws $2 a year

test edition of the Revised Statutes of the United States, with the Session Laws of Congress in continuation; Revised Statutes $4; Session Laws $1.50 a year

Secure by gift:

dinances of the city or village in which the library is situated

oceedings of Board of Supervisors of the county, if the library is in New York State

025.8 SHELF DEPARTMENT

OOK NUMBERS FOR POPULAR LIBRARIES: PROBLEM

Mary Louisa Sutliff

Assign book numbers, as for a popular library, to the following entries. Pencil book numbers at left of author in fiction and below class number in other cases. Follow directions in *Simplified Library School Rules*, 1898, p. 54-59.

1 Perry, Nora. Flock of Girls and Boys. D

2 Kellogg, Elijah. Boy Farmers

3 Smith, F. H. Colonel Carter. 1893

4 914.5 Smith, F. H. Gondola Days

5 Smith, *Mrs* M.. P. (Wells) Jolly Good Times

6 Smith, *Mrs* M.. P. (Wells) Jolly Good Times at Hackmatack

7 Smith, *Mrs* M.. P. (Wells) Jolly Good Times at School

8 Smith, Minna C. Mary Paget

Crawford, F. M. Casa Braccio

Crawford, F. M. Cigarette-maker's Romance

Crawford, F. M. Katharine Lauderdale. 2v.

017 Fitchburg—Public Library. Catalogue

252 Brooks, Phillips. Sermons

252 Brooks, Phillips. New Starts in Life

252 Brooks, Thomas. Unsearchable Riches

16 Hale, E: E. Ten Times One is Ten

17 Hale, E: E. If Jesus Came to Boston

18 Hale, E: E. In His Name

19 Hale, E: E. Ingham Papers

20 Hale, L. P. Peterkin Papers

21 Howells, W: D. Chance Acquaintance. 1890

22 Howells, W: D. Chance Acquaintance. 1877

23 Howells, W: D. Dr Breen's Practice

24 Howells, W: D. Day's Pleasure. T

25 Howells, W: D. Day of their Wedding. D

26 Howells, W: D. Doorstep Acquaintance

27 92 Martyn, Benjamin & Kippis, Andrew. Life of Shaftesbu

28 92 Knox, T: W. Boy's Life of Gen. Grant. 1895

29 92 Abbott, J: S. C. Life of Grant

30 92 Grant, U. S. Personal Memoirs. 2v.

31 92 Garland, Hamlin. Ulysses S. Grant

32 92 Grand Army of the Republic—Rhode Island, Dep't Grant Memorial Service

33 92 Public Honors to Grant

92	Pollard, Josephine.	Our Hero, Grant	
923	Adams, W: H. D.	English Party Leaders	
92	Bisset, Robert.	Life of Burke	
92	Burke, Edmund.	Correspondence of Edmund Burke	
92	Burke, Edmund.	Letter to a Noble Lord	
92	Hart, C: H.	Biography of Lincoln	
92	Herndon, W: H. & Weik, J. W.	Abraham Lincoln	
92	Holland, J. G.	Life of Lincoln	
	Davis, Rebecca H.	Dr Warwick's Daughters.	D
	Davis, R: H.	Cinderella	
	Collins, Wilkie.	Woman in White.	F
	Ward, *Mrs* Humphry.	Marcella	
	Ward, *Mrs* Humphry.	History of David Grieve	
	Ward, *Mrs* Humphry.	Sir George Tressady	
	Ward, *Mrs* Humphry.	Story of Bessie Costrell	
	Ward, H. D.	New Senior at Andover	
917.3	Dickens, Charles.	American Notes	
	Dickens, Charles.	Barnaby Rudge	

70 **822** Shakspere, William. As You Like It; with notes by Phelps

71 **822** Guizot, F. P: G. Shakspere and his Times

72 **822** White, R: G. Studies in Shakspeare

73 Scott, *Sir* Walter. Abbot

74 Scott, *Sir* Walter. Anne of Geierstein

75 Scott, *Sir* Walter. Antiquary

027 HISTORY OF LIBRARIES

027.073 AMERICAN LIBRARIES

Salome Cutler Fairchild

OUTLINE OF MODERN LIBRARY MOVEMENT IN AMERICA WITH MOST IMPORTANT FOREIGN EVENTS

The modern library movement began about 1850, took on its strongest characteristics in 1876 and received a strong forward impulse in 1893.

Before 1850 there were in the United States only 423 public libraries of 1000 volumes or more; in 1900 there were 5383. [United States—Education, Bureau of. *Public, Society and School Libraries.* 1901. p. 923]

Under each year events are arranged as far as possible in chronologic order. State and local organizations are distinguished by an underline.

1638 Harvard University Library founded

1700 South Carolina provincial library law passed for the encouragement of parochial libraries established by Rev. Thomas Bray

1731 Library Company of Philadelphia founded by Benjamin Franklin; characterized by him as the "mother of all the North American subscription libraries"

1796 New Jersey State Library founded

1800 Library of Congress founded

1807 Boston Athenaeum founded

1818 New York State Library founded

1820 New York Mercantile Library founded

1833 Peterboro (N. H.) Public Library founded

1835 New York school district library law passed; the first recognition of the principle of taxation for support of public libraries

1837 Sir Anthony Panizzi became "keeper of printed books" at British Museum. [*Library Journal*, May 1879, 4: 163–65; Fagan, Louis. *Life of Panizzi.* 2v. Lond. 1880]

1841 *Cataloguing Rules* of the British Museum printed

1848 First edition of Poole's *Index* published; 154p. O. (Second edition, 1853, 10+521p. O)

Massachusetts passed library law allowing Boston to tax itself for support of public library

1849 New Hampshire passed library law allowing towns to tax themselves for support of libraries

Astor Library founded; a great endowed reference library, open to the public

1850 First free library act for Great Britain passed through the instrumentality of William Ewart

1852 Boston Public Library founded

1853 Second edition of Poole's *Index* published; 10+521p. O

First convention of librarians held in New York city; 53 delegates present. [*Norton's Literary Gazette*, Oct. 1853, 3:170-76; *Norton's Literary and Educational Register*, 1854, p. 49-94; *Library Journal*, Aug.-Sep. 1886, 11:217-19; May 1902, 27:254-56]

1855 Charles Coffin Jewett appointed librarian of Boston Public Library

1868 Justin Winsor appointed superintendent of Boston Public Library

1871 Cincinnati Public Library opened on Sunday for first time

1872 Illinois free library law passed; copied subsequently by several states

1873 Dr William Frederick Poole appointed librarian of Chicago Public Library

1876 *Library Journal* established

American Library Association founded; first meeting held in Philadelphia

Public Libraries in the United States issued by Bureau of Education; included Cutter's *Rules for a Dictionary Catalogue*

Library Bureau established for manufacture of library supplies

First edition of Dewey's *Decimal Classification* published; 42p. O. (Sixth edition, 1899, 612p. O)

1877 First international conference of librarians held in London

Library Association of the United Kingdom founded. (Chartered in 1898 under the name Library Association)

1880 Publication of *American Catalogue* begun by Frederick Leypoldt

1884 Library school authorized by Columbia trustees

1885 New York (city) Library Club organized

1886 *Library Notes* established; edited by Melvil Dewey

1887 Columbia College School of Library Economy opened

1888 Melvil Dewey appointed secretary of University of the State of New York and director of New York State Library

1889 Columbia College School of Library Economy transferred to New York State Library; name changed to New York State Library School

Association of State Librarians organized as a section of the A. L. A. [*Library Journal*, May-June 1889, 14:278; *Public Libraries* Oct. 1900, 5:325]

University law of New York State passed

1890 New York (State) Library Association organized

Iowa Library Association organized

New Hampshire Library Association organized

Massachusetts Free Public Library Commission established

Massachusetts Library Club organized
New Jersey Library Association organized
Pratt Institute Library School established
891 Wisconsin State Library Association organized
Connecticut Library Association organized
Maine Library Association organized
Michigan Library Association organized
Minnesota Library Association organized
Chicago Library Club organized
Indiana Library Association organized
New Hampshire Board of Library Commissioners established
Cocheco (N. H.) Library Club organized
New York State Home Education Department established; traveling libraries sent to university extension centers
Cutter's *Expansive Classification* published
892 Southern California Library Club organized
Pennsylvania Library Club organized
New York State passed new library laws more fully recognizing importance of libraries
Drexel Institute Library School established
Bibliographical Society (London) organized
893 Colorado Library Association organized
A. L. A. exhibit made at World's Columbian Exposition, Chicago
World's Library Congress held at Chicago
General traveling libraries first sent out by New York State Home Education Department
Connecticut Public Library Committee formed
Newberry Library, Chicago, opened
Department of Library Science of Armour Institute established
894 Library Association of Washington City organized. (Name changed to District of Columbia Library Association, Mar. 13, 1901)
Vermont Library Association organized
Rhode Island librarians made eligible to membership in Massachusetts Library Club
Catalog of "A. L. A." Library completed
895 Astor and Lenox Libraries and Tilden trust consolidated to form New York Public Library, Astor, Lenox and Tilden Foundations
New building of Boston Public Library opened

Papers prepared for the American Library Association for its Annual Meeting held at the Columbian Exposition, 1893 ("World's Fair Papers") issued by United States Bureau of Education

Vermont Free Library Commission established

California Library Association organized

Ohio Library Association organized

Ohio State Library Commission established

Nebraska Library Association organized

Wisconsin Free Library Commission established

Library section of Wisconsin Teachers Association organized

Milwaukee Library Round Table organized

Institut International de Bibliographie (Brussels) founded

1896 Bibliographic conference held in London. [*Library Journal*, Nov. 1896, 21 : 499–500]

National institutions in England (including British Museum) opened on Sunday for first time

Library section of National Educational Association organized

Public Libraries established

Library conference held in Melbourne, Australia

Library Association of Australasia founded

Illinois State Library Association organized

Western Pennsylvania Library Club organized

North Wisconsin Traveling Library Association organized

1897 New building of Chicago Public Library opened

New building of Library of Congress opened

Library section of Illinois Teachers Association organized

Second international library conference held in London

Georgia Library Association organized

Georgia Library Commission established

Twin City Library Club (Minneapolis and St Paul) organized

Department of Library Science of Armour Institute transferred to University of Illinois; name changed to University of Illinois State Library School

1898 Western Massachusetts Library Club organized

Bay Path Library Club (Mass.) organized

Library Club of Buffalo organized

Fox River Valley Library Association of Wisconsin organized

National Association of State Librarians organized as an independent and permanent organization. [*Library Journal*, Dec. 1898, 23: 668–69]

New Jersey Traveling Library Commission established

9 Indiana State Library Commission established

Maine State Library Commission established

Library Art Club (New England) organized. [*Library Journal*, Sep. 1899, 24 : 521–23]

Pennsylvania Library Commission established

Colorado State Board of Library Commissioners established

Kansas State Library Commission established

Michigan State Library Commission established

Minnesota Library Commission established

Bibliographical Society of Chicago organized

Herbert Putnam appointed librarian of Congress

0 Iowa State Library Commission established

Bibliothekarinnenschule established in Berlin

A. L. A. exhibit made at Paris Exposition

International Congress of Librarians held in Paris

New building of Providence Public Library opened

Long Island Library Club organized

Bureau of Library Information instituted by General Federation of Women's Clubs

Verein Deutscher Bibliothekare founded. [*Library Journal*, July 1900, 25 : 334–35]

Ontario Library Association (Toronto) organized

Cape Cod Library Association (Mass.) organized

Missouri Library Association organized

Kansas State Library Association organized

Building of Wisconsin State Historical Society opened

01 Andrew Carnegie's gifts to libraries, from June 1, 1900 to July 1, 1901, aggregated $13,704,700, the most notable gifts being $5,200,000 to New York city and $1,000,000 to St Louis

New York Free Circulating Library merged in New York Public Library

Eastern Maine Library Club organized

Idaho Library Commission established

Tōkeki; official organ of the Kansai Bunko Kyōkai, or Western Library Association (Japanese) established

New building of Newark (N. J.) Free Public Library opened

Nebraska Public Library Commission established

Washington State Library Commission established

Keystone State Library Association (Pa.) organized

Delaware State Library Commission established
A. L. A. exhibit made at Pan-American Exposition, Buffalo
Net price system for books established
Cooperative cataloguing becomes established fact through issue Library of Congress of printed catalogue cards
Nashville (Tenn.) Library Club organized
1902 New York State Library School limits applicants for admission graduates of registered colleges
East St Louis (Ill.) Library Club organized
Maryland Library Commissions established
Brooklyn Library and Brooklyn Public Library consolidated
Tennessee Library Association organized
Illinois State Library Association incorporated
Texas Library Association organized
Andrew Carnegie gives $100,000 to A. L. A. Publishing Board
West Tennessee Library Club organized

027 HISTORY OF LIBRARIES

027.073 AMERICAN LIBRARIES

Salome Cutler Fairchild

PRESIDENTS OF AMERICAN LIBRARY ASSOCIATION

1876–1902

Justin Winsor	1876–85	11	John Cotton Dana	1895–96
William Frederick Poole	1885–87	12	William Howard Brett	1896–97
Charles Ammi Cutter	1887–89	13	Justin Winsor	July–Oct. 1897
Frederick Morgan Crunden	1889–90	14	Herbert Putnam	Jan.–July 1898
Melvil Dewey	Sep. 1890–July 1891	15	William Coolidge Lane	1898–99
Samuel Swett Green	July–Nov. 1891	16	Reuben Gold Thwaites	1899–1900
William Isaac Fletcher	1891–92	17	Henry James Carr	1900–1
Melvil Dewey	1892–93	18	John Shaw Billings	1901–2
Josephus Nelson Larned	1893–94	19	James Kendall Hosmer	1902–
Henry Munson Utley	1894–95			

17 presidents, 19 terms of office
No conference 1878, 1880, 1884
Conference of 1888 special, not general meeting

Justin Winsor

Life 1831–97
Library service 1868–97

iographic sketches

Library Journal, Nov. 1897, 22 : 689 (portrait opposite p. 677)
Harvard Graduates' Magazine, Dec. 1897, 6 : 182–88 (W: C. Lane) 188–91 (W: H. Tillinghast) (with portrait)

ollege connection

Entered Harvard with class of 1853
Studied bibliography and history at Paris and Heidelberg
B. A. Harvard 1868
LL.D. University of Michigan 1887, Williams 1893

ibrary positions

Trustee Boston Public Library 1867–68
Superintendent Boston Public Library 1868–77
Librarian Harvard University 1877–97

L. A. offices

President 1876–85, July–Oct. 1897; presided at second international library conference, London 1897
Councilor 1885–97
Attended annual meetings 1876–87, 1889

nportant publications

Index to Subjects in Reviews and other Periodicals. 154p. O. 1848
Index to Periodical Literature. 531p. O. 1853
With W: I: Fletcher, ed. 3 of *Index.* 1882; first *Supplement to Index.* 1888
Works on historical subjects

ork on other lines

President American Historical Society; member American Antiquarian Society and Essex County Institute; corresponding member of several state historical societies

Charles Ammi Cutter

Life 1837–
Library service 1858–

ollege connection

B. A. Harvard 1855
Harvard Divinity School 1859

ibrary positions

Librarian Harvard Divinity School 1858–59
Assistant Harvard University Library 1861–68
Assistant Boston Public Library 1867–68
Librarian Boston Athenaeum 1869–93
Librarian Forbes Library, Northampton Mass. 1894–

L. A. offices

President 1887–89 Catskills and St Louis
Councilor 1889–1902
Attended annual meetings 1876–94, 1896, 1898–1900, 1902

portant publications

Rules for a Dictionary Catalogue
Expansive Classification. 1891–
Editor *Library Journal.* 1881–93. v. 6–18

Frederick Morgan Crunden

Life 1847–
Library service 1877–

ographic sketch

National Cyclopaedia. 1896. 6:483

llege connection

B. A. Washington University, St Louis 1868

Early occupation

Teacher in St Louis public schools 1868–71, in Washington University 1872–76

Library position

Librarian St Louis Public Library 1877–

A. L. A. offices

President 1889–90 Fabyans

Councilor 1881–83, 1886–87, 1890–95, 1898–

Attended annual meetings 1879, 1883, 1886–87, 1889–90, 1892–1902

Important publications

Function of a Public Library and its Value to the Community

The Free Public Library, its uses and value

The School and the Library

Articles on educational and sociologic subjects

Work on other lines

Member St Louis Artists' Guild, Missouri Historical Society, St Louis Academy of Science, executive committee Missouri Civil Service Reform Association, secretary of committee that framed new charter for Board of Education, St Louis

Samuel Swett Green

Life 1837–
Library service 1871–

Biographic sketch

Library Journal, Aug. 1891, 16:233 (with portrait)

College connection

B. A. Harvard 1858

Harvard Divinity School 1864

Early occupations

Bookkeeper in Mechanics National Bank and teller in National Bank, Worcester Mass.

Library positions

Member board of directors Worcester (Mass.) Free Public Library 1867–71

Librarian Worcester (Mass.) Free Public Library 1871–

Member Massachusetts Free Public Library Commission 1890–

A. L. A. offices

President July–Nov. 1891 San Francisco (completing the term of Melvil Dewey)

Councilor 1885–87, 1891–95

Attended annual meetings 1876–87, 1889–94, 1896–97, 1899, 1902

mportant publications

Numerous articles and addresses on the relation of the public library to the public schools, Sunday opening of libraries, etc.

Vork on other lines

Member American Antiquarian Society, American Historical Association, American Archaeological Institute, National Geographic Society, New England Historic Genealogical Society, Colonial Society, Bunker Hill Monument Association and Society of Descendants of Colonial Governors; corresponding member Wisconsin Historical Society; fellow American Geographical Society and Royal Historical Society of Great Britain

William Isaac Fletcher

Life 1844–
Library service 1861–

ollege connection

Honorary M. A. Amherst 1884

ibrary positions

Assistant Boston Athenaeum 1861–66
Librarian Bronson Library, Waterbury Ct. 1869–72
Librarian Lawrence (Mass.) Public Library 1872–74
Assistant librarian Watkinson Library, Hartford Ct. 1874–83
Librarian Connecticut Historical Society, Hartford Ct. 1874–83
Librarian Amherst College 1883–
Director Department of Library Economy Sauveur Summer School, Amherst Mass. 1891–

.. L. A. offices

President 1891–92 Lakewood
Councilor 1892–1902
Member Publishing Board 1886–
Attended annual meetings 1877–79, 1883–94, 1896–1902

mportant publications

Editor (with Poole) *Index to Periodical Literature.* Ed. 3. 1882, also *First Supplement to Index.* 1888
Editor *Second and Third Supplements to Index.* 1893 and 1897
Editor *A. L. A. Index to General Literature*
Public Libraries in America
Alphabetical Index to the Catalogue of the Library of the late George Brinley
Editor (with R: R. Bowker) *Annual Literary Index, 1892–*

Josephus Nelson Larned

Life	1836–
Library service	1877–97

Early occupations

Superintendent of education, Buffalo 1872–73

Journalism

Library positions

Superintendent Buffalo Library and Buffalo Public Library 1877–97

Member of board of managers and chairman of library committee of Buffalo Historical Society 1895–

A. L. A. offices

President 1893–94 Lake Placid

Councilor 1886–87, 1892–

Chairman A. L. A. committee on selection of books for *Catalog of "A. L. A." Library* 1892–93

Attended annual meetings 1879–88, 1892, 1894–98, 1900

Important publications

Editor *Literature of American History*

History for Ready Reference

Henry Munson Utley

Life	1836–
Library service	1885–

College connection

B. A. University of Michigan 1861

Early occupation

Journalism

Library position

Librarian Detroit Public Library 1885–

A. L. A. offices

President 1894–95 Denver

Councilor 1887–92, 1895–1900, 1901–

Attended annual meetings 1885–87, 1889–98, 1900–1

John Cotton Dana

Life	1856–
Library service	1890–

College connection

B. A. Dartmouth 1878

Herbert Putnam

Life 1861–
Library service 1884–

iographic sketch

Library Journal, Feb. 1895, 20:66; Mar. 1899, 24:97 (with portrait)

ollege connection

B.A. Harvard 1883
Lit.D. Bowdoin 1898
Partial course Columbia Law School

arly occupation

Law

ibrary positions

Librarian Minneapolis Athenaeum 1884–87
Librarian Minneapolis Public Library 1887–91
Librarian Boston Public Library 1895–99
Librarian of Congress 1899–

. L. A. offices

President Jan.–July 1898 Lakewood (completing the term of Justin Winsor)
Councilor 1895–
Attended annual meetings 1886, 1889, 1896, 1898–99, 1901–2

nportant publications

Valuable articles in the *Atlantic Monthly*, *North American Review*, *Forum*, *Outlook* and *Educational Review*

William Coolidge Lane

Life 1859–
Library service 1881–

ollege connection

B.A. Harvard 1881

ibrary positions

Assistant Harvard University Library 1881–87
Assistant librarian Harvard University 1887–93
Librarian Boston Athenaeum 1893–98
Librarian Harvard University 1898–

. L. A. offices

President 1898-99 Atlanta
Councilor 1894–
Member Publishing Board 1886–
Attended annual meetings 1885–86, 1890, 1892–93, 1896, 1898–1900, 1902

Early occupations
Accountant and cashier in commercial and railroad offices 1867-86

Library positions
Librarian Grand Rapids (Mich.) Public School Library 1886-90
Librarian St Joseph (Mo.) Free Public Library 1890-91
Librarian Scranton (Pa.) Public Library 1891-

A. L. A. offices
President 1900-1 Waukesha
Councilor 1896-1901
Treasurer 1886-93
Recorder 1893-95
Secretary 1898-1900
Attended annual meetings 1879-90, 1892-1902

John Shaw Billings

Life	1837-
Library service	1864-

Biographic sketch
Library Journal, Feb. 1896, 21:63-65 (portrait opposite p. 51)

College connection
B.A. Miami University 1857
M.D. Medical College of Ohio 1860, Munich 1889, Dublin 1892
LL.D. Edinburgh 1884, Harvard 1886, Budapest 1896, Yale 1901, Johns Hopkins 1902
D. C. L. Oxford 1889
R. C. P. I. 1892
R. C. S. I. 1892

Early occupation
Surgeon United States Army 1861-95

Library positions
Librarian United States Surgeon General's Office Library, Washington 1864-96
Director New York Public Library, Astor, Lenox and Tilden Foundations 1896-

A. L. A. offices
President 1901-2 Magnolia
Councilor 1879-87
Attended annual meetings 1881, 1883, 1898-1900, 1902

Important publications

Index-catalogue of the Library of the Surgeon General's Office, United States Army

National Medical Dictionary

Ventilation and Heating

Report on Vital and Social Statistics in the United States at the 11th Census, 1890

Work on other lines

Professor of hygiene, University of Pennsylvania 1893–96; member of about 15 societies and honorary member of 28 others; curator Army Medical Museum and Library, Washington 1883–92; director Laboratory of Hygiene, University of Pennsylvania 1892–96; vice chairman Carnegie Institution 1902–

James Kendall Hosmer

Life	1834–
Library service	1892–

Biographic sketch

Library Journal, Oct. 1896, 21:457

College connection

B.A. Harvard 1855

Ph.D. University of Missouri 1877

LL.D. Washington University, St Louis 1897

Early occupations

Pastor First Church, Deerfield Mass. 1860–66

Corporal of Color Guard, 52d regiment Massachusetts volunteers, 19th army corps

Professor rhetoric and English literature, Antioch College 1866–72

Professor English and history, University of Missouri 1872–74

Professor English and German literature, Washington University 1874–92

Library positions

Trustee St Louis Public Library 1886–92

Librarian Minneapolis Public Library 1892–

A. L. A. offices

President 1902–

Councilor 1900–

Attended annual meetings 1893–94, 1896–1902

Important publications

- *Short History of German Literature*
- *Story of the Jews* (Story of the Nations Ser.)
- *Young Sir Henry Vane*
- *History of the Louisiana Purchase*
- Also numerous other historical works

Work in other lines

- Member Minnesota Historical Society

028 SELECTION OF BOOKS

PERIODICALS USEFUL FOR BOOK REVIEWS

Salome Cutler Fairchild

General and literary

American Monthly Review of Reviews, 1891–date. v. 3–date, illus. sq. O. N. Y. 1891–date. Rev. of Rev. Co. $2.50 052 R321

v. 1–2, 1890, were identical with the English edition of *Review of Reviews*.

Atlantic Monthly; devoted to literature, science, art and politics. v. 1–date, O. Bost. 1858–date. Houghton $4 051 At6

Book Buyer; a review and record of current literature. v. 1–date, O. N. Y. 1867–date. Scribner $1.50 015.73 B64

Not published between 1877 and 1884.

Book News; a monthly survey of general literature. v. 1–date, illus. Q. Phil. 1883–date. Wanamaker 50c 051 qB64

Bookman; an illustrated magazine of literature and life, 1895–date. v. 1–date, illus. Q. N. Y. 1895–date. Dodd $2 051 qB641

Catholic World; a monthly magazine of general literature and science, 1865–date. v. 1–date, O. N. Y. 1865–date. Catholic World $3 205 C28

Critic; an illustrated monthly review of literature, art and life, 1881–date. v. 1–date, illus. v. 1–32, Q; v. 33–date, O. N. Y. 1881–date. Putnam $2 051 C86

v. 1–2, fortnightly; v. 3–32, weekly; v. 33–date, monthly.

Dial; a semi-monthly journal of literary criticism, discussion and information. v. 1–date, Q. Chic. 1881–date. Dial Co. $2 051 qD54

v. 1–12, monthly.

Harper's Monthly Magazine, 1850–date. v. 1–date, illus. O. N. Y. 1850–date. Harper $4 051 H23

Harper's Weekly; a journal of civilization, 1857–date. v. 1–date, illus. v. 1–46, no. 2375, F^5; v. 46, no. 2376–date, F^4. N. Y. 1857–date. Harper $4 071

Literary World, 1870–date. v. 1–date, sq. F. Bost. 1870–date. Hames $1 051 qL711

v. 1–9, monthly: v. 10–31, no. 5, fortnightly; v. 31, no. 6–date, monthly.

Nation; a weekly journal devoted to politics, literature, science and art, 1865–date. v. 1–date, sq. F. N. Y. 1865–date. Nation $3 071 qN21

New York Times; Saturday Review of Books and Art, Jan. 2, 1897–date. F^5. N. Y. 1897–date. N. Y. Times $1 051 fN42

Religion

American Catholic Quarterly Review, 1876–date. v. 1–date, O. Phil. 1876–date. Amer. Catholic Quar. Rev. $4 205 Am3

American Journal of Theology, 1897–date. v. 1–date, O. Chic. 1897–date. Univ. of Chicago $3 205 Am35

Quarterly.

Sociology

American Journal of Sociology; bimonthly, July 1895–date. v. 1–date, O. Chic. 1896–date. Univ. of Chicago $2 305 Am31

Journal of Political Economy. v. 1–date, O. Chic. 1893–date. Univ. of Chicago $3 330.5 J821

Quarterly.

Political Science Quarterly; a review devoted to the historical, statistical and comparative study of politics, economics and public law; ed. by the faculty of political science of Columbia University. v. 1–date, O. Bost. 1886–date. Ginn $3 305 P75

Quarterly Journal of Economics. v. 1–date, O. Bost. 1887–date. G. H. Ellis $3 330.5 Q2

Published for Harvard University.

Economic Journal; the journal of the British Economic Association. v. 1–date, Q. Lond. 1891–date. Macmillan 5s 330.5 qEc7

Quarterly.

Economic Review; published quarterly for the Oxford University branch of the Christian Social Union. v. 1–date, O. Lond. 1891–date. Rivington 10s 330.5 Ec71

Yale Review; a quarterly journal for the scientific discussion of economic, political and social questions, May 1892–date. v. 1–date, O. New Haven 1893–date. Tuttle, Morehouse $3 305 Y1

Succeeds *New Englander and Yale Review.*

Educational Review; monthly, Jan. 1891–date. v. 1–date, O. N. Y. 1891–date. Educ. Rev. $3 370.5 Ed 82

Journal of American Folk-lore. v. 1–date, illus. O. Bost. 1888–date. Houghton $3 398 J82

Quarterly.

Science

Journal of the Franklin Institute; devoted to science and the mechanic arts, 1826–date. v. 1–date, illus. O. Phil. 1826–date. Franklin Inst. $5 605 I6

Monthly continuation of *American Mechanics' Magazine.*

Popular Science Monthly, 1872–date. v. 1–date, illus. O. N. Y. 1872–date. Science Press $3 505 N2

Science; a weekly journal devoted to the advancement of science, publishing the official notices and proceedings of the American Association for the Advancement of Science, 1883–date. v. 1–date, v. 1–9, O; v. 10–23, F; v. 24–date, Q. N. Y. 1883–date. Macmillan $5 505 qO3

Knowledge; an illustrated magazine of science, literature and art. v. 1–date, illus. Q. Lond. 1882–date. Knowledge 7s 6d 505 qO2

v. 1–8, weekly; v. 9–date, monthly.

Nature; a weekly journal of science, 1869–date. v. 1–date, illus. Q. Lond. 1870–date. Macmillan 1£ 8s 505 qNo

History

American Historical Review; quarterly, Oct. 1895–date. v. 1–date, Q. N. Y. 1896–date. Macmillan $4 973 qAm35

English Historical Review; quarterly, 1886–date. v. 1–date, v. 1–2, O; v. 3–date, Q. Lond. 1886–date. Longmans 5s 905 En3

Geography

Geographical Journal, including the proceedings of the Royal Geographical Society, 1893–date. v. 1–date, maps, O. Lond. 1893–date. Royal Geog. Soc. 2s 910.5 G29

Scottish Geographical Magazine, 1885–date. v. 1–date, illus. maps, O. Edin. 1885–date. Royal Scottish Geog. Soc. 1s 6d 910.5 Sco8

Monthly.

028 SELECTION OF BOOKS

028.2 PRINCIPLES OF BOOK ANNOTATION

Salome Cutler Fairchild

A book note is a characterization of a book for purposes of selection on the part of readers or librarian.

The object of a reader's note is to help each reader who may meet the book in the library to decide whether he wishes to read it.

The object of a librarian's note is to help the librarian to decide whether it is wise to add a certain book to his collection, and also to what groups of people or particular individuals the book will appeal.

The reader's book note, therefore, must be written from the standpoint of the reader, the librarian's book note from the standpoint of the librarian. The two notes for the same book will consequently often be different in form, in spirit and in substance.

The reader's book note should be descriptive, appealing and sometimes critical. The critical element should always be subordinated.

The librarian's book note should be descriptive and critical. An attempt to combine the objects sought in a reader's book note and a librarian's book note is likely to result in a note which is appropriate to neither. Both, however, should be fair and discriminating and based on definite knowledge of the book.

The following statement of a few principles that should guide the writer of reader's book notes assumes that all the books for which notes are written are both *of interest* and *of value* to at least part of the readers.

The writer of a reader's book note must grasp what is vital in the book discriminating between the essential and the immaterial; he must decide not only intellectually but sympathetically to what people the book will appeal; finally he must describe the book so as to reproduce its atmosphere and spirit and make the people to whom it belongs, i. e. to whom it naturally appeals, want to read it. This come-and-read-me air will at the same time attract those to whom the book belongs and save the people who do not like that kind of a book from reading it. The note should as a rule be written for the people to whom the book will appeal, not primarily to discourage those who ought to be warned against it. In other words the quality of the note should be positive not negative.

The following note on Mrs Oliphant's *Jean D'Arc* is strictly truthful and suits the readers who would find Francis Lowell's *Joan of Arc* useful, but it ought to be made to suit the class who would not care for Lowell and who would find Oliphant much more to their purpose. "A gracefully written, but somewhat hysterical biography of the Maid of Orleans. Strives to combine fact with picturesqueness, but does not succeed in giving an accurate or well balanced account of the period or of the character. Sympathetic in the main, it is a much slighter and less profitable work than Lowell's." A more satisfactory note would be "A life of Joan of Arc from the standpoint of the enthusiastic admirer; not so reliable or scholarly as the life by Lowell but charmingly written and perhaps more interesting to most readers."

It is unbecoming and quite apart from his function for the writer of a book note to take sides in any mooted question. Compare the following note on Kropotkin's *Fields, Factories and Workshops* "Contains some interesting chapters on agriculture, and one on education; but his ideal, that each nation should be her own agriculturist and manufacturer, and sufficient unto herself *seems both impracticable and undesirable*" with "A plea for the decentralization of industries, the combination of trades with agriculture, of brain work with handiwork. Fortified by practical examples from personal investigation, those drawn from agriculture being especially strong. Its genuine enthusiasm and temperate statements will win the interest of the most skeptical."

Reader's book notes fail of their purpose if run in a mold. Set phrases are very undesirable. With them it is impossible to give the spirit of a variety of books. Originality and diversity are important characteristics.

The style and language of the note should fit the character of the book. "An elementary investigation of the structure and habits of the bee" is a perfectly truthful statement regarding Morley's *Bee People*, but the statement is so inappropriately worded that it gives an entirely false idea of the book. Contrast it with the following, intended for the use of children: "All about the bees—queen bee, workers and drones. Tells about their 12,603 eyes, the way they get the honey from the deep flowers, the way they comb their hair and the way they feed the baby bees." Simple Anglo-Saxon words seem to fit best a book written in a simple style. "The formation, characteristics and habits of the honeybee" is not so suitable a description of *Bee People* for an adult as "A book telling about bees, how they are made, what they do and how they should be treated."

In writing a note for a book which is hazy and dreamy, and poetic in style, make sure that in trying to give the atmosphere of the book you do not make your note itself hazy and dreamy. A note for this style of book, as for every other, should give the reader a *clear* idea of the book. One is likely to fall into this mistake in writing a note for a book like Maeterlinck's *Wisdom and Destiny*.

In writing a reader's book note for a public library make sure that it not only gives a clear and appropriate idea of the book, but also that it is likely to strike the ordinary everyday reader favorably. Avoid such a note as the following for *Wisdom and Destiny:* "An individual philosophy of life which is rare, delicate and fragile, beautiful as a floating mist." It is a very pretty note, and perhaps gives a fair idea of the book and might not be an unsatisfactory note for a select body of readers, but it would surely strike the average reader in a public library as lacking in good sense. Prefer e. g. "A philosophy of life essentially happy in its conception, centering in the thought that destiny can not utterly destroy the wise. Somewhat mystical and elusive but always healthy and lofty in tone and full of poetic beauty."

It is very important to begin a note in such a way as to attract the reader. Hyde's *God's Education of Man* is a book that appeals to many readers. A majority of those who read the first words of the following note would scarcely go any further. "Sin, redemption and sanctification are the subjects of the three main chapters in which vital principles in the old theology are made the basis of the reorganized faith in harmony with scientific thought." Those who would care for the book would be more likely to read it if it were introduced to them by such a note as "A practical book stating the commanding doctrines of religious life and thought in forms that appeal to the experience of men of today. Not at all controversial in spirit, deeply religious in tone and stimulating in its effect on thought and action, it will appeal to readers of widely differing views."

In issuing a book there are three ways in which an author uses his material which has been previously printed in magazines.

1 A direct reprint; e. g. Eliot's *Educational Reform*

2 Rewritten matter, using material of the article

3 Issuing in book form matter printed in parts in a magazine

1 should be mentioned in the book note; for 2 and 3 it is not necessary. The reader has a right to expect to find a subject treated with the unity of a book unless told that he will find the disconnected treatment of a collection of addresses on the same general subject. Some readers would prefer the disconnected treatment of magazine articles.

Do not repeat what is expressed in the title unless for clearness or emphasis.

A note for fiction should not give the plot or story.

For a book suited to the general reader, avoid unusual words. Do not use such an expression as "his knavery being extrinsic rather than intrinsic" or "details his life history, dwelling particularly on causative facts."

Avoid unusual and doubtful expressions in making quotations even though the author of the review is a good authority. For example, Lyman Abbott, in reviewing the *Life of Henry Drummond* by Smith says, "So vital a man," meaning apparently virile, or a man with so much vitality. It is an uncommon use of the word "vital" and might strike the reader unpleasantly. Avoid for the same reason, "weaved a web," taken from one of the best reviews.

When good critics disagree do not decide. Some critics say that Cable's *Strong Hearts* is equal to his earlier stories; others that it is inferior. It is inappropriate to attempt to settle this question in a book note.

Reread your own notes to make sure that the participles fit the nouns to which they refer. It is easy if the participle and noun are in different parts of the sentence not to notice that they do not belong together; e. g. "A strong romance of the second crusade, excellently told"; we tell a tale, but we do not tell a romance: or, "Voyage of a whaling vessel in the south seas told by one of the seamen"; we do not tell a voyage, but the story of a voyage.

028 SELECTION OF BOOKS

28.5 AIDS TO SELECTION OF BOOKS FOR CHILDREN

Compiled by Martha Thorne Wheeler

urt, Mary Elizabeth. Literary Landmarks; a guide to good reading for young people, and teachers' assistant. 152p. D. Bost. 1889. Houghton 75c 028.5 B95

Uncommonly useful and suggestive. Discusses theory, instances books practically tested and gives book list with publishers, prices and occasional opinions from well known people.

riswold, William McCrillis. Descriptiv List of Books for the Young. 175p. Q. Camb. Mass. 1895. W: M. Griswold, paper $1; cloth $1.25 028.5 qG88

Classified, with descriptive notes of varying length, generally quoted from periodicals.

ardy, George E. Five Hundred Books for the Young; a graded and annotated list. 94p. D. N. Y. 1892. Scribner 50c net 028.5 H22

Shorter and rather more select than Sargent list. Arranged under class, for grades 3 to 6. Gives title, author, illustrations, paging, publisher, price. Fact that compiler was a Roman catholic guaranties that books are free from anticatholic bias.

argent, John Frederick. Reading for the Young; a classified and annotated catalog with an alphabetical author-index. 121p. Q. Bost. 1890. Library Bureau, paper 75c; cloth $1 028.5 qSa7

— —— Supplement, with alphabetical author-index and subject-index to the complete work; comp. by M. E. and A. L. Sargent. p.122-225, Q. Bost. 1896. Library Bureau, paper 75c; cloth $1 028.5 qSa72

New edition including both parts, 225p. $1.50.

Arranged in order of *Decimal Classification*, without class numbers. Gives author, title, age letter and note, but neither publisher nor price. Includes references to *St Nicholas*, *Wide Awake* and *Youth's Companion*. Excludes the really objectionable, but is somewhat too hospitable to the mediocre. Convenient in form and of value as full list of older books.

Brief general lists

lbany, Children's Home Libraries. List of Books in Children's Home Libraries. 7 sheets D. Albany n.d. 5c 028.5

Catalogues of first six libraries.

arnegie Library of Pittsburgh (Pa.)—Children's department. Home Library: finding lists. nar. T. Pittsburg n.d. 1c each 028.5

Catalogues of libraries 1-8 and 17. Notes addressed to children.

Columbian Reading Union. List of Books for the Young. 8p. O. n.p. n.d. 10c. *o.p.* 028.5

Short list prepared for Roman catholic boys and girls by the Columbian Reading Union, 415 W. 59th st. N. Y. Of value in selecting books for home library groups or in other work where the importance of considering religious differences is obvious.

Hewins, Caroline Maria. Books for Boys and Girls. 31p.Tt. Bost. 1897. Library Bureau 10c. (A. L. A. Annotated Lists) 028.5

Classified. Age letter, author, title, publisher, price, many notes.

Library lists

Boston—Public Library. Selected List of Books for Younger Readers; revised to July 1898. Ed. 3. 67p. S. n.p. n.d. 1c 028.5

A supplementary list of six pages was issued September 1900.

Classified arrangement giving author, title and call number, followed by alphabetic title list.

Brookline (Mass.)—Public Library. List of Books for Boys and Girls, 1900. 128p.D. Brookline, Sep. 1900 028.5

Classified. Author, title, call number.

Buffalo (N. Y.)—Public Library. Interesting Books for Boys and Girls from 14 to 18 Years Old; selected and annotated by F. L. Rathbone and Mrs H. L. Elmendorf. 11p.O. Buffalo, Jan. 7, 1898. (Reading Lists on Special Topics, no. 3) 028.5

Call number, author, title, note. Arranged in order of *Decimal Classification.*

——— List of Books in the Children's Department. 35p. O. Buffalo, May 1898. 10c 028.5

Classified; author and title only.

Hartford (Ct.)—Public Library. Boys' and Girls' Books. Ed. 2 enl. 103p. O. Hartford 1895 028.5 H25

Classified. Author, title, call number. Contents often given; very few notes.

Milwaukee (Wis.)—Public Library. List of Picture Books for Very Little Folk. 7p. S. n.p. Oct. 1895. (Our Books, v. 1, no. 2) 028.5

85 titles. Title, author, illustrations, place, size, call number.

N. Y. (State)—Traveling Libraries Division. Finding Lists. no. 19, 20, 22, 23, 26, 28, 31, 34, 37, 42, 47, nar. T. Alb. 1895-1901 017.1 N424f

Children's libraries, 25 volumes each. Short cataloguing, publisher, price, *Abridged Decimal Classification* number, note. No. 47 issued on typewritten sheets.

Newark (N. J.)—Free Public Library. Special Number for Boys and Girls. O. Newark 1899–1902. (*in* Library News, Aug.–Sep. 1899, v.10, no. 8–9; Oct. 1900, v.11, no. 10; Ap.–June 1901, v.12, no. 4–6; Mar.–Ap. 1902, v. 13, no. 3–4) 028.5

Classified selection of children's books in the library, supplement to first selection, and author lists. Gives author, title and call number. Call numbers in author lists show Newark plan of classifying fiction by subject. Number for Mar.–Ap. 1902, arranged by authors, contains many books in the earlier lists with some additions.

Lists prepared for schools

Buffalo (N. Y.)—Public Library. Classroom Libraries for Public Schools, listed by Grades; to which is added a list of books suggested for school reference libraries. 134p.O. Buffalo, Feb. 1902. 31c 028.5

Author, title, publisher, price. Arranged alphabetically by authors under grades 1–9, and provided with alphabetic subject index giving references to analytics as well as books, and author-title index.

Carnegie Library of Pittsburgh (Pa.) Graded and Annotated Catalogue of Books in the Carnegie Library of Pittsburgh for the Use of the City Schools. 317p. O. Pittsburg 1900 028.5 C21

Classified by subject under grades 1–9. Supplementary lists for teachers, on kindergarten, pedagogy and art. Gives author, title, call number and note. Author and title index.

Evanston (Ill.)—Free Public Library. Graded and Annotated List of the 500 Books in the School Libraries. 61p. O. Evanston 1902. 10c 028.5

Classified and subdivided by grades. Author, title, publisher, price, brief notes. Appended, lists of stories of adventure for boys, stories for girls from 12 to 18 and stories of Indians and cowboys, with call numbers. Author and title index.

Glens Falls (N. Y.)—Public Schools. Course in Reading and Literature. 33p.nar.T. n.p. 1896 028.5

Courses covering 12 school years and list of historical fiction arranged under countries by century. Gives author, title and prominent person or event.

N. Y. (State)—Library. Class List of a $500 Library recommended for Schools. Ed. 3. p.956–1032, O. Alb. 1901. 15c. (Bibliography 30) 028.5 N421

Classified. Author, title, publisher, price, *Abridged Decimal Classification* number. Includes reference books and many books for teachers. List of recommended editions of books required in Regents courses in literature and supplementary reading list for English courses appended. The few notes are mainly on editions.

Osterhout Free Library, Wilkesbarre (Pa.) Teacher's Catalogue of Books suitable for Primary and Grammar Schools. 46p. T. Wilkesbarre 1893 028.5

Classified. Author, title, date, call number.

Providence (R. I.)—Public Library. Consolidated List of School Duplicates; part 1, annotated list in a single alphabet; part 2, volumes arranged by the separate grades. (*see its* Monthly Bulletin, Jan. 1898, 4 : 9–26) 016 qP941 v.4

Price 2c. Author, title, call number, note. Includes many books written for adults but of value in connection with school work.

Wisconsin—Schools, State Sup't of. List of Books for High School Libraries. 151p. O. Madison 1900 028.5

Classified, with indexes of titles and authors. Full description, publisher, list and net prices, notes.

—— List of Books for Township Libraries. 344p. O. Madison 1902. 25c 028.5

Arranged under primary, intermediate and grammar grades, and subdivided by subject. Full description, publisher, list and net prices. Rather leisurely notes and frequent references to other books or chapters bearing on topic. Brief lists for teachers and farmers appended. Author and title index and alphabetic subject index Has much useful matter but arrangement is confusing.

Sunday school lists

Albany, Emmanuel Baptist Church. Catalogue of the Sunday School Library. 64p.O. Alb. 1901. 15c 027.8 Al1

Age letter and note. Author list and title index, 850 titles. Compiled by M. T. Wheeler, librarian and chairman of selection committee.

American Unitarian Association. Annual List of Books for Sunday-school and other Libraries, recommended by the ladies' commission on Sunday-school books. S. Bost. 1895–date. Amer. Unit. Ass'n, 25 Beacon st. 027.8

Consolidated lists issued for 1885–89 and 1890–94 now out of print. Authors and titles in one alphabet. Author, paging, publisher, price, age symbol and note given under title entry. Of much value to other denominations as well as unitarians.

Church Library Association. Catalogue of Books recommended for Sunday School Libraries and Parish Libraries. 110p. S. Camb. 1900 027.8

Annual supplements. Address Secretary of Church Library Association, Cambridge Mass. sending 25c in stamps. Books read by committee of episcopalians; selection based on written reports. Arranged as books which bear directly on church life, history or doctrine and books recommended but not distinctly church books, each list being subdivided by classes. Full description, publisher, price, many notes.

Connecticut Ladies' Commission on Sunday School Books. List of Books approved by the Sunday-school Book Commission of the Connecticut Congregational Club, including the general list revised to 1892 and the annual supplements. 47+8+10p. D. Hartford 1895. Hartford Seminary Press 10c 027.8 C76

Selection based on written reports. Arranged alphabetically by title. Gives author, paging, publisher, price, age letter, note.

Lists on special subjects

Hyatt, Bertha Evelyn. Biography for Young People. p.37–92, O. Alb. 1901. 15c. (N. Y. State Library Bibliography 32) 016.92

Collective works alphabeted by authors; individual lives under biographees arranged alphabetically; classified list of subjects and index of authors and biographees. Full cataloguing, publisher, price, State Library call numbers and notes.

Olcott, Frances Jenkins. Fairy Tales for Children. p.339–64, O. Alb. 1898. 5c. (N. Y. State Library Bibliography 13) 016.3982O11

Mythology, folklore and fairy tales, subdivided by countries, and wondertales, picturesque and grotesque, arranged as collections and single stories. Full cataloguing, publisher, price, State Library call numbers and notes.

NEW YORK STATE LIBRARY BIBLIOGRAPHIES

Except no. 21, 23, 29, 30, 33 and 34 the following bibliographies have been prepared by students of the New York State Library School, on subjects of their own choice, as a condition of graduation. Gaps in the series show that the numbers omitted are replaced by later editions or for other reasons are out of print.

6–8 Japan; Venice; Out-of-door Books. 64p. Feb. 1898. *10c.*
9–11 The Netherlands; Renaissance Art of 15th and 16th Centuries; History of Latter Half of 15th Century. 128p. Ap. 1898. *15c.*
13 Fairy Tales for Children. 30p. June 1898. *5c.*
14 Index to Subject Bibliographies in Library Bulletins to Dec. 31, 1897. 62p. Aug. 1898. *10c.*
19 College Libraries in the United States. 52p. Dec. 1899. *10c.*
20 House Decoration and Furnishing. 20p. Dec. 1899. *5c.*
21 Best Books of 1899. 28p. May 1900. *5c.*
22 Domestic Economy. 144p. Jan. 1901. *20c.*
23 Connecticut Local History. 114p. Dec. 1900. *15c.*
24 New York Colonial History. 272p. Feb. 1901. *35c.*
25 China and the Far East. 122p. Mar. 1901. *20c.*
26–27 Fröbel and the Kindergarten; (with) 27 Reading List for Children's Librarians. 92p. May 1900. *15c.* No. 27, *separately, 5c.*
28 Maine Local History. 148p. June 1901. *20c.*
29 Best Books of 1900. 32p. July 1901. *10c.*
30 Class List of a $500 Library recommended for Schools. 82p. July 1901. *15c.*

First two editions were printed as Extension (Home Education) bulletins 14–15.

Selection of books for reference and general reading. Editions have been carefully chosen with regard to print, paper, editing and cost.

31 Monopolies and Trusts in America. 38p. Oct. 1901. *10c.*
32 Biography for Young People. 62p. Nov. 1901. *15c.*
33 French Government Serials. 72p. Jan. 1902. *15c.*
34 Best Books of 1901. 30p. June 1902. *10c.*

LIBRARY SCHOOL BULLETINS

2 Library School Register 1887–96. 50p. Jan. 1898. *5c.*
3 12th Annual Report of Library School 1898. 28p. il. Ap. 1899. *5c.*
4 Selected Reference Books. 70p. Oct. 1899. *10c.*
5 Selected Subject Bibliographies. 50p. Nov. 1899. *5c.*
6 13th Annual Report of Library School 1899. 30p. Dec. 1899. *5c.*
7 Selected National Bibliographies. 34p. May 1900. *5c.*
8 14th Annual Report of Library School 1900. 36p. Jan. 1901. *5c.*
9 Handbook of New York State Library School, including Summer Course and Library Handwriting. 66p. Sep. 1901. *15c.*
10 15th Annual Report of Library School. 28p. Mar. 1902. *5c.*
11 Library School Register 1887–1901. 80p. June 1902. *15c.*
12 Lecture Outlines and Problems. 66p. Oct. 1902. *15c.*

New York State Library School

RELATIONS TO NEW YORK LIBRARY SYSTEM

While the University of the State of New York, incorporated May 1, 1784, is a supervisory and administrative, not a teaching body, the Library School is an essential factor in the new work undertaken by the University when reorganized in 1889. By the new University law the Regents are made distinctly responsible for the library interests of the State. New York led all the states in caring for that education which can be given to the people at large only through public libraries, by establishing in 1838 the district library system, an example followed by 20 other states.

Careful examination of the causes which led to the decline of the system 15 years later showed clearly that the comparative failure was due to lack of proper administration, and that if the taxpayers' money was to do its full work there must be systematic training in the elements of librarianship for those who were to carry on this important part of educational work. Such training could clearly be best and most economically given, not at a college, but in the State Library and in daily communication with the department intrusted with the administrative library work of the State. Thus in the library field the State is repeating its experience with the public schools, from which no satisfactory results could be had, in spite of great appropriations, till normal schools and academic training classes were established to prepare teachers for their work.

To meet this need, the library school which opened at Columbia University Jan. 5, 1887, was transferred Ap. 1, 1889, to the State Library at Albany, with its faculty and collections. Since the transfer the school has steadily increased its entrance requirements and the extent and thoroughness of its teaching.

Admission. Candidates must be graduates of registered colleges, of recognized fitness and character and not less than 20 years of age. They must pass examination in general literature, history and three years work in foreign languages, preferably French and German, unless these subjects have been satisfactorily covered by their college course.

Summer course. An elementary summer course intended for assistants and librarians of the smaller libraries who can not leave their positions for the full course is also given. For those engaged in library work in New York State the summer course is provided without charge as part of the work of the Home Education Department.

Published monthly by the
University of the State of New York
[illegible] [illegible]

High School Department

Bulletin 17

NEW YORK STATE SCIENCE TEACHERS ASSOCIATION

PROCEEDINGS OF THE

SIXTH ANNUAL CONFERENCE

Held at Syracuse University, Syracuse, December 27-28, 1901

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University of the State of New York

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University of the State of New York

High School Department

INCLUDING ACADEMIES AND ALL INTERESTS OF SECONDARY EDUCATION

Bulletin 17

New York State Science Teachers Association

PROCEEDINGS OF THE

SIXTH ANNUAL CONFERENCE

Held at Syracuse University, Syracuse, December 27-28, 1901

SUMMARY OF SESSIONS

Friday, December 27, 9.30 a. m.

Meeting of executive council

Registration

Opening session; called to order by Professor CHARLES W. HARGITT, Syracuse University

Address of welcome

Professor CHARLES W. HARGITT

Response

Professor FRANKLIN W. BARROWS, Buffalo Central High School, president-elect

Value of Research Work in the Training of the Science Teacher

Professor SAMUEL J. SAUNDERS, Hamilton College, Clinton

Discussion

Professor CHARLES W. HARGITT, Syracuse University

Professor A. J. GROUT, Brooklyn Boys High School

Inspector ARTHUR G. CLEMENT, Regents office, Albany

Professor FRANKLIN N. JEWETT, Fredonia Normal School

Professor GEORGE M. TURNER, Masten Park High School, Buffalo

Professor N. A. HARVEY, Chicago (Ill.) Normal School

Professor SAMUEL J. SAUNDERS, Hamilton College

Professor ALBRO D. MORRILL, Hamilton College, Clinton

Friday, 2 p. m.

General session

The Study of Types

Professor N. A. Harvey, Chicago (Ill.) Normal School

Discussion

Professor Grant Karr, Oswego Normal School
Professor Charles W. Hargitt, Syracuse University
Professor N. A. Harvey, Chicago (Ill.) Normal School
Professor Albert P. Brigham, Colgate University, Hamilto

Friday, 4 p. m.

Section meetings

Section A—Physics and chemistry. Professor J. M. Jameson Pratt Institute, Brooklyn, *chairman*

Preparation and Training of the Teacher of Physics

Professor Charles B. Thwing, Syracuse University

Discussion

Professor George M. Turner, Masten Park High School Buffalo
Professor W. M. Booth, Cortland Normal School
Professor Charles B. Thwing, Syracuse University
Inspector Charles N. Cobb, Regents office, Albany
Professor Howard Lyon, Oneonta Normal School
Professor Charles F. Binns, N. Y. State School of Cla Working and Ceramics, Alfred
Professor H. J. Schmitz, Geneseo Normal School

Preparation and Training of the Teacher of Chemistry

Professor Lyman C. Newell, Lowell (Mass.) Normal School

Section B—Biology. Professor Henry R. Linville, DeWitt Clinton High School, New York, *chairman*

Preparation of Secondary Teachers in Biology

Professor Francis E. Lloyd, Teachers College, New York

Discussion

Inspector Arthur G. Clement, Regents office, Albany
Professor Francis E. Lloyd, Teachers College, New York
Professor Henry R. Linville, DeWitt Clinton High School, New York
Professor Frank M. McMurry, Teachers College, New York

What the Teacher of Botany in Secondary Schools should be Prepared to Do

Professor A. J. GROUT, Brooklyn Boys High School

Discussion

Professor FRANCIS E. LLOYD, Teachers College, New York

Section C—Earth science. Professor RICHARD E. DODGE, Teachers College, New York, *chairman*

Geography for Training Students in Normal Schools

Professor AMOS W. FARNHAM, Oswego Normal School

Professor C. STUART GAGER, New York State Normal College, Albany

Relations of Life to Environment

Principal C. T. MACFARLANE, Brockport Normal School

Position of Anthropo-geography in Normal School Teaching

Professor W. S. MONROE, Westfield (Mass.) Normal School

Discussion

Professor FRANK CARNEY, Ithaca High School

Professor ALBERT P. BRIGHAM, Colgate University, Hamilton

Professor C. STUART GAGER, New York State Normal College, Albany

Principal C. T. MACFARLANE, Brockport Normal School

Professor W. S. MONROE, Westfield (Mass.) Normal School

Professor RICHARD E. DODGE, Teachers College, New York

Section D—Nature study. Mrs MARY ROGERS MILLER, College of Agriculture, Cornell University, Ithaca, *chairman*

What is the Minimum Nature Study Training for a Teacher in an Elementary School?

Superintendent DARWIN L. BARDWELL, Binghamton High School

Discussion

Mrs MARY ROGERS MILLER, Cornell University, Ithaca

Superintendent DARWIN L. BARDWELL, Binghamton High School

Where and How can Nature Study Training be Obtained?

Miss ELIZABETH CARSS, Teachers College, New York

Miss ALICE CYNTHIA KING, Utica City Training School

Discussion

Mrs Mary Rogers Miller, Cornell University, Ithaca
Professor C. S. Sheldon, Oswego Normal School
Professor Arthur E. Hunt, Manual Training High School, Brooklyn
Professor N. A. Harvey, Chicago (Ill.) Normal School
Professor John W. Spencer, Cornell University, Ithaca
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Professor R. J. Kittredge, Schenectady Union Classical Institute

Discussion

Professor H. J. Schmitz, Geneseo Normal School
Professor Charles F. Binns, N. Y. State School of Clay-Working and Ceramics, Alfred

Chemical Laboratory Notes

Professor Charles M. Allen, Pratt Institute, Brooklyn

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Professor Ernest N. Pattee, Syracuse University
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How to Meet the Problem of Teaching Physics by the Laboratory Method in Secondary Schools

Professor Frank M. Gilley, Chelsea (Mass.) High School

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Ideals in Teaching

Professor Albro D. Morrill, Hamilton College, Clinton

Discussion

Professor Henry R. Linville, DeWitt Clinton High School, New York
Professor A. J. Grout, Brooklyn Boys High School

Professor A. D. MORRILL, Hamilton College, Clinton
Professor N. A. HARVEY, Chicago (Ill.) Normal School
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Saturday, 11.15 a. m.

General session

Report of committee on a standard college entrance in botany

Professor Francis E. Lloyd, Teachers College, New York

Symposium: What Ought the High School Teacher in each Science to Know? What Ought he to be Able to Do? What are his Opportunities for Self-improvement?

Professor Lyman C. Newell, Lowell (Mass.) State Normal School

Professor Henry R. Linville, DeWitt Clinton High School, New York

Saturday, 2 p. m.

General session

Report of progress of the committee on stimulants and narcotics presented by

Professor Irving P. Bishop, Buffalo Normal School, *chairman*

Alcohol Physiology in the Public Schools

Professor W. O. Atwater, Wesleyan University, Middletown Ct.

Statement concerning Steele's *Hygienic Physiology*

Mrs Mary H. Hunt, superintendent of scientific department of Woman's Christian Temperance Union

Discussion

Dr Henry D. Didama, Syracuse University

Mrs Mary H. Hunt, superintendent of scientific department of Woman's Christian Temperance Union

Professor Irving P. Bishop, Buffalo Normal School

Professor Burt G. Wilder, Cornell University, Ithaca

Mrs Ella A. Boole, Brooklyn, president of New York State Woman's Christian Temperance Union

Professor Albert P. Brigham, Colgate University

Mrs Cora D. Graham, Syracuse, Frances Willard Memorial Union

Professor Frank Carney, Ithaca High School

Professor Richard E. Dodge, Teachers College, New York

Mrs Martha M. Allen, superintendent nonalcoholic medication for national Woman's Christian Temperance Union

Adjourned

SUMMARY OF ACTION

Appointments

Friday afternoon the following committees were appointed to report at the final session.

Nominations. Professor W. H. Lennon, Brockport, chairman; E. R. Whitney, Binghamton; Professor George M. Turner, Buffalo.

Resolutions. Professor Francis E. Lloyd, New York, chairman; Arthur G. Clement, Albany.

Auditing committee. O. C. Kenyon, Syracuse, chairman; John W. Greenwood, Buffalo.

Report of meeting of executive council

Saturday afternoon the secretary made the following oral report:

Recommended, That the association pay to the Regents office for proceedings of the fourth annual meeting, $50.

That the bill for postage for mailing to members the proceedings of the fifth annual meeting be paid, $27.

That the bill for reprints of the papers read at the fifth annual meeting be approved, $62.61.

That the bills for taking and transcribing the notes at the fifth annual meeting be paid, $62.75.

That the expenses of the committee on narcotics be paid by the association, $30.

The secretary stated further that at the meeting of the executive council held at the Hotel Warner the previous evening the place for the next meeting was discussed; that the invitation from Buffalo was presented and discussed, and that it was finally

Voted, That it be recommended to the association that the city of Syracuse be selected for the next annual meeting, and that Prof. Lovell be appointed a committee of one to confer with the Associated Academic Principals and if possible arrange for a session in unison.

Also that, on the recommendation of Prof. Dodge, it was

Voted, That there be appointed a chairman and secretary for each of the four sections, and that the appointment thereof be left in the hands of the president and council.

All the recommendations of the executive council were unanimously approved and adopted.

Treasurer's report

For the year ending Dec. 28, 1901

Receipts

From O. C. Kenyon, treasurer	$226 54	
Annual dues	128 ..	
Interest	1 50	
		$356 04

Payments

Stenographers for the fifth annual meeting	$62 75	
Stationery and blanks	12 75	
1899 reports, paid to the Regents	50 ..	
Postage	10 ..	
Mailing 1900 reports	27 ..	
Reprints, J. B. Lyon	62 61	
Printing programs and letter	22 50	
Mailing programs and letter	13 ..	
Express and cartage	1 45	
Five dinner tickets for guests	3 75	
C. W. Hargitt, expense	65	
F. W. Barrows, expense	4 15	
H. R. Linville, expense	50	
Trunk Line Association	4 ..	
Labor and clerk hire	27 ..	
		302 11
Balance on hand Dec. 27, 1901		$53 93

Committee reports

Nominations. The committee recommended the following as officers of the association for the ensuing year, and they were unanimously elected.

President, William Hallock, Columbia University

Vice-president, Howard Lyon, Oneonta Normal School

Secretary and treasurer, A. R. Warner, Auburn High School

Executive council, E. S. Babcock, Alfred University; H. J. Schmitz, Geneseo Normal School; W. M. Bennett, Rochester High School

Resolutions. The following resolutions were reported and adopted.

We, the members of the New York State Science Teachers Association, assembled in conference at Syracuse N. Y. Dec. 27 and 28, 1901, do hereby extend our most hearty thanks to those who have so liberally contributed to our comfort and convenience,

To the city of Syracuse for the use of the city hall where we are at present,

To the university authorities, and more specially to the dean and faculty of the medical college, for their courtesy in extending to the association the use of their building,

And to Prof. C. W. Hargitt, Mr O. C. Kenyon and Mr J. D. Wilson, the local committee, for the efficient way in which they have arranged for the details of the meeting.

We hereby resolve that a copy of this minute be copied on the records of the association, and that the secretary be instructed to convey in writing the sense of the resolution to those mentioned.

The following resolution from the earth science section was presented and adopted.

Resolved, That the committee of seven be continued for one year, that they may outline a series of laboratory exercises in physical geography, and suggest a course of study in geography for elementary schools.

Auditing committee. The auditing committee has examined the accounts and report of the treasurer, A. R. Warner, and finds them to be correct.

John W. Greenwood
O. C. Kenyon

Miscellaneous

Friday afternoon Inspector Charles N. Cobb called attention to the fact that in connection with the Associated Academic Principals meeting there had been arranged an exhibit of science apparatus for physics and chemistry particularly, on the second floor of the Yates hotel at the end of the corridor at the left after leaving the elevator.

ADDRESSES, PAPERS AND DISCUSSIONS

Friday morning, December 27

GENERAL SESSION

Prof. C. W. Hargitt—In the absence of the retiring president, I have been asked as chairman of the local committee to call the meeting to order and to introduce the president-elect. It is not necessary to spend time in words of formal welcome. The sixth annual session makes the third out of a series held in Syracuse, and the second of a series held in this building. I am very sure that those of you who have been at previous meetings are quite aware of the fact that as teachers and as science teachers, you are welcome in Syracuse and here in this building. I think moreover that no words of mine are necessary in the way of congratulation to the science teachers of the state on the work of this association in the past years of its history. A glimpse at the program in the standard of work proposed for this meeting and in the quality of material in the way of speakers provided to participate in the work of the session is sufficiently assuring on this point. We have been strikingly favored in the brief years of our history in being able to command the services not only of the science teachers of the state, but of many of the foremost science teachers and investigators of the country. Our scientific friends have been more than generous in this respect. They have come to us from the older East and from the younger, if not more active and enterprising West, and have contributed each in his way to the promotion and success of the work of the Science Teachers Association.

Without further multiplying words, I may simply say that you are welcome to Syracuse University and to the medical department, under whose roof we are housed today. It is now my pleasant privilege and honor to introduce to you the president-elect, Dr Franklin W. Barrows of the Buffalo High School.

Dr Franklin W. Barrows—*Mr Chairman, Ladies and Gentlemen:* I am sure that the small attendance at this opening meeting need not discourage us in any way, for the fact that we have accepted the hospitality of Syracuse University is a good omen. Our meetings in Syracuse have always been satisfactory and enthusiastic. You, Dr Hargitt, and the university are assured that we feel at home with you and in your city. It is both fortunate and unfortunate that there are two associations meeting here at the same time which demand the attention and interest of our members. The reason that we have not more at this opening session is because a number of our members are in the meeting of the associated principals and some of them are taking part in the program.

We are fortunate this year in that we have been able to make some progress in the work for which the association was organized. Two committees are working on important topics. A committee of seven are at work on the subject of earth science and the suggestion of courses of study. The committee on stimulants and narcotics, five members under Prof. Bishop, reports its progress tomorrow afternoon.

It is not necessary to inform those who have looked over our program that for this session the papers have been selected with the central idea of suggesting the proper preparation and training of science teachers. The program has somewhat the appearance of sameness, in that the phrase "the training of teachers" appears in so many places in the announcements of the section meetings and of the general convention. This is no mistake nor oversight. The committee, the members of the council and the chairmen of the sections have striven to emphasize this matter more than ever before, and perhaps with the special view of being helpful to teachers in the secondary schools.

Without further remarks on the program or on the other features of the meeting, it gives me great pleasure to introduce to you a gentleman who, as a professor in the colleges of the state, has had as much to do as anyone with the equipment and training of science teachers. I have the pleasure of introducing Prof. Samuel J. Saunders of Hamilton college, who will address you on the "Value of research Work in the Training of the Science Teacher".

VALUE OF RESEARCH WORK IN THE TRAINING OF THE SCIENCE TEACHER

BY PROF. SAMUEL J. SAUNDERS, HAMILTON COLLEGE

We often hear the opinion expressed that the modern methods of education do not produce as good results as the old-fashioned ones. Is this true, or is it but the croak of the pessimist? Be that as it may, the questions and discussions at such gatherings as this make it evident that our modern methods are not yet entirely satisfactory. Is the fault in the choice of subjects, or in the teachers and their training? What do we mean by "good results"? What do we ask our teachers to do for us, and for our rising generation? These questions seem to bring us to a consideration of the best methods of education.

The test of every educational system is the product which it forms. It should produce men who think and decide for themselves, men of action, who make their mark in the world, who succeed in whatever they undertake, whether the problem be scientific or social. It should make of the average man an intelligent, clear-thinking, truth-loving and cultured citizen. The object of education is to expand and train the mental faculties, to teach people how to think for themselves; and *that* discipline is the most valuable which makes us the most self-reliant, and enables us to make the best use of our reason and judgment with respect to all matters pertaining to our own welfare and that of the community.

In that delightful book, *Helen's Babies*, the author strikes a chord which finds a response in every human breast, when he represents the three year old hero insisting that his uncle open his watch and let him "shee wheels go wound". For centuries that cry has gone up from the children of men. All are curious to peer into the machinery of the universe and learn if possible how and why the "wheels go round". There is a deep seated desire in every child to find out the reason of things, and this spirit of inquiry should be fostered and developed; it is one of the first essentials in research.

The work of the school should connect with the child's previous interests, and continue the educative process of the earliest years, which is always of the nature of original research. The excellence of science, as a means of teaching people how to think, is no longer questioned. Even with a view to culture, science, when properly taught, is one of the best means of educating the highest faculties of the human mind. By proper teaching we do not mean the mere learning of a lot of scientific facts, but discipline in the methods of science. Mere head knowledge may do a man very little good; it is the habit of mind and the training in method that determines the character of the man. As an instrument of human progress the greatest value of science is manifested in scientific inquiry, or research, and no amount of mere learning, or mechanical skill, can take its place. The progress in science and industry is due to the spirit of inquiry and inventiveness developed by research methods of training, and these methods should be applied throughout the whole educational course of every individual.

What do we mean by the research method? We may define it briefly as being, "The putting of related experiences together and finding things out for ourselves".

All education, which attains its highest ends, is of the nature of original research. In this sense, that is to say, of adding to our knowledge by our own efforts, we have all been, to a greater or less extent, engaged in research work since the moment of our birth, and there is no period in life when the research method is more accurately and successfully applied than during our early years. The young child learns the meaning of a word, tone, look, or action, by putting together various instances of its occurrence, forming a conception of its significance, testing the correctness of this conception by repeated observations and modifying it as experience widens.

As we grow older, and are able to understand the answers and explanations of others, our power of applying the research method seems to fall off rapidly. The ease with which we can then obtain information by asking questions does away with the necessity for much mental effort on our part, and we gradually cease to investigate for ourselves, this power dying away with disuse like any other power. Moreover, we fall into the habit of appealing to, and relying on, authority. The child should be placed under such conditions that his desire for the acquisition of knowledge can be kept alive and fostered, and so that he does not lose the habit of systematically searching for truth by the aid of known truths, and testing the validity of each step by constant reference to experience and experiment.

It is important that this power of applying the research method, this acquiring of science-forming ideas, should be raised to as high a pitch of efficiency as possible before we stand face to face with the problems of life. It becomes more and more difficult to begin to apply this method as we advance in years. It is unwise then to postpone its cultivation till we have entered on the special duties of our life work. It should be cultivated, as we have said, during the whole school career from the kindergarten up.

Much of our modern education fails because many subjects, even the sciences, are learned as the dates of important events in history are learned; the memory alone is exercised, reason and judgment do not come into operation, unless it be merely to refer matters to some authority which is considered final. It fails too because the pupil is not trained to apply his knowledge. It is by constantly making practical use of the knowledge we possess that the power of making original application of knowledge is best brought out. The pupil should test his knowledge continuously, and learn "to do by doing". In language study he should translate from one language to the other till he has acquired readiness and facility in the process; in mathematics he must work problems, and in the sciences he must prove his theories by experiment. He should use his knowledge and reasoning with respect to some phenomenon, and then test his ideas by experiment. The result usually shows him that his preconceived opinions must be modified, or perhaps wholly abandoned; that there are laws which must be discovered by patient labor and investigation. He realizes also, that he must be constantly on his guard against errors, that he must become acquainted with the sources of these errors and learn to fulfil the conditions necessary to avoid them. He may be able to learn a great deal about the truths and principles of science, and their experimental illustrations, by reading about them in a good textbook; he learns more, if in addition to the reading he can see the experimental illustrations and demonstrations performed by another; but he learns most and best by doing them himself. There is nothing that brings the truth home to the mind so well as experimental proofs carefully carried out for one's self. The possession of knowledge does not confer on a man the ability to use it, and the possession is of no value if it can not be used and applied. If our one talent is to gain other 10 talents, it must not be buried in the earth. The research method means simply the using of the knowledge we have, to gain more. For the student, for every one, whatever his profession or calling, there is but one thing essential to success—he must acquire knowledge, and the power to search out knowledge for himself through his own experiences. The man of business must have not only a knowledge of things, but also of principles and methods, and his success is proportional to the skill with which he applies such knowledge. He must note carefully the satisfaction or discontent of his customers, put his experiences together and learn from them general rules, which he makes more and more accurate as time goes on.

That knowledge which we have acquired by serious thinking and hard work we are apt to value and remember; it becomes, at least, a more secure possession than that which has been easily and lazily gathered while enjoying a cigar and fan. The difficulty of a book, or subject, is not in itself an objection to its use in education, for to learn how to overcome difficulties is a very valuable part of the training. Mathematics are hard, and Greek is hard, and that is one of the reasons why they are such excellent educational subjects. In the present day, however, when there is so much to learn, we are always on the lookout for the royal road, and even when we have done our best to smooth the way, there is considerable difficulty left.

Language study furnishes abundant opportunity for the application of the research method; it involves the continual putting together of the known to arrive at a knowledge of the unknown; a constant modification of, and addition to, our ideas of the meanings and usages of words and phrases, as experience widens. In these studies too much help is often furnished the student. There are grammars and dictionaries giving all the shades of meaning, and minute details regarding the make-up and use of the different words and phrases; there are also the annotated texts furnishing additional notes, and helps over the hard places, to say nothing of the interlinear and literal translations better known as "cribs", "ponies" or "horses".

The sciences are often taught as if the object of the study was simply the acquirement of a store of useful information, and there are epitomes of the latest results in each branch of science which the student can read and memorize. There is nothing of the research method in this, it calls for no original application of knowledge already possessed, no drawing on experience, none of the mental faculties except the memory is exercised to any extent.

Even for the experimental work, there are elaborate manuals in which nearly everything is worked out for the student, and he is told just what to do and how to do it, and what he should expect to see. The work is merely a training in mechanical operations, not intellectual discipline. If he does not obtain the results indicated, he goes over the work again, he relies on authority and not on himself. It is a good thing for the beginner to verify for himself well established laws, and to cultivate manipulative skill and dexterity, but experimental work should also cause the student to observe and think for himself. The misuse of such helps may defeat the highest aims of the studies in which they are used.

Our modern system of education should stand out against the abuse of authority and memory. The lack of time, and the necessity of mastering a certain amount of information in which examinations have to be passed, are perhaps the main causes of these abuses. Examinations, as they are usually given, test only the memory, not the powers of reasoning and judgment.

Culture does not depend so much on the subjects, as on the method and persistence with which they are pursued. It is no argument against the study of the classics, that the proper study of science makes keen thinkers and able men, for the classics properly pursued will do the same; nor, on the other hand, is it any argument against the sciences that the classics have produced the profound thinkers and eminent scholars of the past. Who will ever know how many thousands there were, during the past centuries, who had no love for the study of classics or mathematics, and who had no opportunity to test the educative power of other studies?

The boys in schools used to be divided, I believe, into classical boys, mathematical boys, and good for nothing boys, this last division existing chiefly because their intellectual blades required a different process of sharpening from the others.

It is estimated that about 2% of all boys are clever, and for a clever boy any subject of study is good enough, one perhaps as good as another, if it enables him to come into close mental contact with great thinkers. But what about work for the other 98%, the average boys and the dull boys? The study of the sciences proves to be the intellectual salvation of many of these. It arouses some minds which nothing else seems to reach, and it develops and trains in all cases faculties which otherwise would have remained dormant.

Progress is always greater when the work is pleasant, and there are so many ways of study offered by the sciences that one has a chance to select that which is most attractive for him, and instruction from the teacher need not change or hinder his own natural method of study. Some branches are almost purely observational; but if he prefers abstract reasoning he takes up the mathematical side; or if he loves to make apparatus and use it he approaches the subject on the experimental side.

A twofold advantage is claimed by the advocates of science studies; first, that they are a means of the best mental training, and second, that they communicate a kind of knowledge which is of practical use in everyday life. It has been said that the teaching which limits the range of a man's vision to the subjects and facts of which he can see the use does not deserve the name of education, the very essence of which is the strengthening of the intellect by mental exercise. But in these days of fierce competition in the industrial world, we must study more and more those truths and principles of abstract science which lie nearest the useful. There are many problems in nature the solution of which would confer great material benefits on mankind in general, and in which the processes and methods involved in carrying them to a successful conclusion, are identical with those which the problems of pure science require, while the discipline and training imparted are equally good. I am not encouraging the idea that utilitarianism should be made the end and aim of education, but what is the advantage of making a close study of the planet Mars, for instance, its markings, its climate and its physical conditions when we know little or nothing of the composition of the earth's crust, or of water, or air or the glass in our windows, or what the nature of the light is that shines through them? The widest culture is the noblest culture. Universality and thoroughness may go together, but why do we so often go far afield for subjects for investigation and study, when there is much that is just as good near at hand, and perhaps more likely to prove useful in everyday life?

There is a kind of knowledge that is actually becoming a necessity. It is that knowledge which best unlocks nature's storehouse, and enables us to wrest from her more than has ever been obtained before, that knowledge which will enable us to find out and use powers of nature which have never been used before. The great success of Germany in commerce and manufactures is due to the particular attention paid to the physical sciences. Sooner or later knowledge and method and industry must tell. Dr Lockyer, the English astronomer, said recently in an address. "I look upon scientific education as a great and necessary line of defense for our country, perhaps scarcely secondary to our naval and military forces."

The connection between scientific and technical education is a close one. In the laboratories new discoveries are constantly being made, science makes known to us new properties and qualities of matter and mechanical invention applies these discoveries to industrial processes. A thorough training in abstract science is a necessary groundwork for a technical education, for how can one understand the practical applications of a science unless he is familiar with the underlying principles of that science? To specialize without the proper preparation is like building the top story of the house first; when it is completed you have but a one story house, and it sits on the ground.

The applied science of the future is now in the process of formation in the operations of those who are working in pure chemistry and physics. Thousands of investigators are patiently working in the laboratories in all parts of the world to bring out new knowledge, and each year now witnesses more discoveries than a century used to. A renowned painter was once asked which he regarded as his greatest painting; he answered "The one I am about to paint". The greatest discovery in science is "The one that is about to be made". The best teaching inspires the student with the conviction that he also can work out new truths, and make some permanent additions to human knowledge.

A scientific man, as such, is valuable according to the amount of new knowledge he is able to bring out, or if he is not engaged directly in research, according to the number and ability of the workers which he prepares and equips for the bringing out of new knowledge. We lead in the struggle for commercial supremacy among the nations of the world, partly because of our great natural resources, but largely because we have such a good supply of investigators and well trained managers, and workmen competent to take instant advantage of every discovery in science. We must maintain, or even increase, the number and efficiency of such men, and must afford them the facilities for acquiring the necessary scientific knowledge and training. The investigators and managers perhaps receive their training in the universities or technical schools, but the workmen, who should be sufficiently well trained to take the initiative whenever necessary, must depend entirely on what they receive in the public and high schools. If in these schools they are taught to understand and apply the best known general principles they will be able, later, to master a given set of practical details with readiness and facility. To the science teachers then belongs in a large measure, the task of preparing all these, so far as education is concerned, for their work in life.

Every teacher who teaches science thoroughly is training skilled teachers for the rising generation. He should have not only a thorough knowledge of his subject, but the ability to impart that knowledge to others, and the willingness to do his utmost.

It is, of course, indispensably necessary that he should be well grounded in his work, and should have a thorough comprehension of the methods and principles of his branch of science, but there is for the teacher even though a specialist a great value in general culture. The man of broad culture and refinement seems to impress his ideas on the pupil's mind in a way that makes them stick. The teacher who knows his special subject well, but not much in other lines has difficulty in doing this. The twofold caution so often given by Bacon against overgeneralization on the one hand, and against overspecialization on the other is still as deserving as ever of the attention of mankind.

A man, in climbing to the peak of a mountain, meets with many difficulties, but experiences pleasure in overcoming them and in enjoying as he rises a wider and more commanding view of things beneath him. If now he wishes to guide others to the top, he must come down again to the valley, put himself in close touch with those to be guided, perhaps even roping himself fast to them, and lead them by the way which he took, cutting steps and footholds in the difficult places, and being always ready to cheer and support the drooping and exhausted. He would accomplish nothing by declaiming from the top, however eloquently he might describe the beautiful scene spread out around him, or however vigorously he might shout his directions as to the proper path to take.

Happiness has been defined as "The state of satisfaction engendered by success in surmounting the material difficulties of life". For a clear and vigorous mind it is a source of intense pleasure to master new ideas. The best progress in study is made for the sake of that reward alone. It must have been this pleasure of overcoming the difficult, the love of truth for truth's sake, that led to the researches of the old Greek geometers, for it was not till the time of Galileo and Kepler that the knowledge of conic sections was of the slightest practical use to science; but they built better than they knew, for it is safe to say, that without their contributions there would have been no Kepler, without Kepler no Newton, and without Newton no such conception of nature as we now have, of nature which is subject in its every phenomenon to exact and definite laws.

A recent writer says that science is ever seeking to write in pure symbols, hence it is not comparable with what we understand by literary work. Some of the grandest truths may be presented to the mind by means of pure symbols.

There are truths which can not well be expressed in any other way. It is said that Newton after waiting for years to secure accurate data was so overpowered by emotion, as he neared the end of his calculations, that he was unable to finish them, but called another to do so for him. Yet what Newton saw was a few pure symbols, a simple arithmetical expression. But that simple expression revealed to him the fact that every particle of matter attracts and is attracted by every other in the universe. He was thrilled by emotions which language is powerless to express or describe. Have you ever gazed on a scene of such grandeur and magnificence that you realized that language was perfectly inadequate, that you could not even attempt a them with others. In science we are much more concerned with the quantitative relations than with the qualitative, and as our knowledge increases that part of it which is mathematical also increases and becomes in many cases quite difficult. In planning and conducting operations in research work there is abundant opportunity for the development of the constructive imagination, originality of mind, and inventiveness. He must change his apparatus and appliances to meet the requirements of the problem in hand, or perhaps devise and construct new pieces as he amends his processes. Patient industry and self-denial, which are the first conditions of scientific investigations, develop self-reliance, and impart strength and solidity to character. With what wonderful patience and perseverance did Kepler work! For 22 years he read the face of the starlit heavens, tracing and measuring with patient exactness the positions and paths of his celestial wanderers, before he was able to deduce from his results the laws of their motion. Every notable scientific achievement rests on a long continued series of patient observations.

Research work calls into active play the powers of the imagination. A noted critic has said that the two men whose imaginations were the most brilliant of any of their day were Michael Faraday and Charles Darwin. All the phenomena with which the scientific investigator deals are concerned with the actions of the invisible and unseen on the visible. There are force, energy, electricity, the universal ether, and many other such subjects or conceptions to consider and explain or describe, and the imagination is often unequal to the tasks imposed on it.

A French bishop, who had become greatly troubled over the nebular hypothesis, or the six literal days of *Genesis*, or something of that sort, preached a sermon in which he inveighed fiercely against science and scientific men, with a repetition of that condemnatory vigor which landed Galileo in prison. At the close of the service a noted astronomer went up to him and said "Monseigneur have you never seen God?" "No," said the surprised bishop "I never have." "Then, your grace, I have" was the reply. "I have seen him in the great cathedral of the universe, I have felt him in the movements of creation, I have witnessed his workings from nebula to star and from star to planet, I have read those scriptures of the sky which you have not, I have touched his robe and know him as a visible being."

In research work our ideas are of value only so far as they are true. Perfect frankness and truthfulness of mind are indispensable to success. Each new problem must be approached with the mind open for the reception of new truth, and all preconceived opinions must be laid aside or held subject to revision. It often requires the utmost skill and attention to sift the truth from the error. One must be careful and accurate both in measurements and statements. Extreme accuracy often leads to valuable discoveries. The discovery of the aberration of light would not have been made if Bradley had not been able to measure accurately to one one hundredth of 1¢. To the fact that Rayleigh was not content to allow the small discrepancy of one part in 10,000 to pass unnoticed, the discovery of argon is due.

Scientific investigation trains in mechanical operations, in manual dexterity and manipulative skill. There is constant adjusting and handling of apparatus, and many operations which are apparently easy, require a deftness and accuracy of touch which comes only from practice. Research work strengthens the memory, for the investigator must remember a large number of facts, and their mutual relations. It brings home to the mind of the investigator the fact that he must stand entirely on his own merits. Credentials, certificates and diplomas avail him nothing. He realizes that they are no more than the stamp on a coin, which makes it a counterfeit unless the metal itself be genuine. Last, research is one of the most vital factors in the promotion of civilization, one of the most powerful levers of national prosperity and influence. Time will not allow, if indeed it were necessary, to call attention to the wonderful discoveries of even the past decade. And yet how many of us think of the latest discovery as if it were really the very last that can be made. Research will never proclaim any proud period and her work accomplished, it grows from more to more. The good ship Discovery is well under way, and the ocean of triumphant progress in unbounded.

Prof. C. W. Hargitt—I hope everybody will not wait for everybody else to say a word on this very fruitful topic and on the very admirable presentation to which we have listened. Every proposition made, it seems to me, must appeal to all and to some measure become inspirational. Some of us who listened to the address last evening by Pres. Draper concerning the primary duty of the teacher to impart some measure of inspiration, have had brought anew to us this morning the same idea, and I think the reader of this paper has made clear to us that it is not primarily the work of science to afford information alone, but it seems to me that he has made it clear that inspiration is one of its primary ends, and I feel that in so far as the science teacher may fail in that primary end of his work, he fails in his work. What we need is not simply the acquisition of knowledge, of mechanical skill or of technical ability so much as the capacity to inspire the boys and the girls, and whether teachers in the schools or in the higher departments of university or college work, it seems to me that one of the primary aims in science work is to inspire.

Such papers and ideals as these which this association has taken pains to emphasize are among the most hopeful signs of the times. Let us have done with the idea that the aim and end of science is knowledge or skill or even the ability to earn a livelihood, but that it is to open the mind, to remove the scales from blind eyes, to compel deaf ears to hear, to open anew to the rising generation the avenues through which the world of nature around us appeals to us.

Prof. A. J. Grout—At the risk perhaps of anticipating some things I planned to say this afternoon, I want at this time to propose a question which seems to be of vital importance, because there are a number of people here I will not be able to reach this afternoon.

To my mind the greatest obstacle to science teachers doing just the kind of work suggested is the tryanny of examinations, college, Regents, or whatever you call them. Suppose you teach by research methods in the secondary schools, what will it profit you on examination day? And our students must pass the examinations or the work is discredited. The examination of today, as I see it, is a test of cyclopedic knowledge, and I want to suggest one thing now, can not the Science Teachers Association do something to make our examinations not a hindrance but a help along these lines of work?

Inspector Arthur G. Clement—I wish to express my appreciation of the valuable paper presented. It seems to have touched on the fundamental principle which ought to inspire all science teachers, to get the students to discover facts for themselves and not take everything for granted and learn merely from textbooks. We are apt to think that research work is only for people who have studied a long time and who have made some great discoveries and are still endeavoring to make further research.

I think the speaker brought out the point well that even young students are doing research work, provided they take things at firsthand and work out their ideas before looking into the textbooks. I have read somewhere that very many great discoveries have been the result of accident, but it is to be noted that these supposed accidents never occur to people not attempting to do research work. Those doing research work frequently make a discovery other than what they are looking for. Therefore we ought always to encourage students, as they may discover something of great value in the scientific world, though not the truth for which they were seeking.

The last speaker spoke of the tyranny of Regents examinations. As I happen to be in the employ of the Regents, I wish to say just a word and to insist that there is no such tyranny when the examinations are properly used. For instance the examinations given in physics or botany. It can hardly be called tyrannic to ask a student 15 questions, of which only eight are required to be answered, specially when 15 questions cover quite a range of matter. If the student has done the work it is a very easy matter to sit down and write out answers to eight of them.

Dr Grout—I want to say for myself that I never personally suffered from that tyranny—that those questions in that science are not tyrannic, but can not questions be devised to test the students' power to do the work? Of course most of the questions have to be, under the present system, a test knowledge of the facts. I want to see questions which test the students' ability to do the work, and where a school is equipped with a laboratory, it is practicable.

Inspector Clement—I must insist that the questions are all right. When we ask the student to write out an account of an excursion he has made with the class, dwelling on the observations he has made pertaining to geology or physical geography it is certainly a fair question and gives a chance for a person to tell what he knows. This is simply an illustration.

Prof. Franklin N. Jewett—I am in sympathy with the writer of the paper. I have asked pupils, which they preferred in doing experimental work, to know the result in advance or to discover it, and I have been surprised, not quite dismayed, but surprised and interested at finding that a great majority preferred to know the result in advance. They said that then they liked to work better. I simply know that students are capable of doing fine work under that plan. They are greatly interested and do extra work in the laboratory, and come in after school and work till dark on a process which usually tells what to expect, striving to find the answer as we did in arithmetic when the answer was under the problem and not in the back of the book.

This has not convinced me, however, that the report is to be taken at par. I am not convinced that the sense or experience on which these pupils based their reply was entirely normal or best, but I present the matter and want to know if anyone can tell me how general this impression may be among the pupils; how it takes and how it works. I can not get the conviction out of my mind that the proper way is the way of discovery, and I have always wished in later years that I might have had more opportunities for such discovery when younger.

I have also thought—I presume there is no question about it as everybody knows it—that the scientific world is getting its information by reading more than by the laboratory. If I am wrong I would like to be corrected. No people more than scientific people get together and hear each others papers read. That is literary work, textbook work. A man goes through a process, a series of experiments, and his reports are printed and become common property of the scientific world. This feature has its place, as marking humanity and distinguishing it from the lower animals. Where has it a place, in the beginning of school life? When should it come in in large measure? These, to me, practical questions, I do not mention with the expectation of having them entirely settled. There are two sides to the matter and I do not wish to limit either side unduly. I hope to make more observations on this subject.

The question arises how far shall we push conclusions beyond experiments. I must confess I would like to see the experiment tried of teaching some of the sciences to persons who should have no textbooks and no access to textbooks. If any have had such experience, I would be glad to hear from them.

Prof. George M. Turner—I like Prof. Saunders's use of the term "research work". I confess that it has never appealed to me quite as it has this morning. I have always felt that a teacher in a high school was not quite in the position where he could do original work, as a professor in college could. I am willing to grant that I have experienced, and no doubt many others in this room have experienced, such feelings as described, that one might have on finding something new to themselves, not to the world, but to themselves.

The use of the term is a good one. From this standpoint, why do not the boys and the girls do research work every time they go into the laboratory? The work and results are in most cases discoveries from their standpoint. The previous gentleman remarks that he thinks his pupils are more inclined to have the answer given before the work than afterward. In many cases I think that is all right. Why not? The pupil does not go into the laboratory, as I understand it, for the purpose of discovering the laws. He is not there for that purpose. He goes there to win the power to use his hands, to train his mind and to draw proper conclusions from what he has done. Why should not the pupil, knowing beforehand what to look for, use his hands just as well? Knowing where and how to look, why should he not have this same satisfaction when he has gotten something new to himself, that the research man has when he finds something new to the world as a whole?

From a personal standpoint, I never shall forget the first time I went into a dark room to develop a plate and brought out an image produced by an x-ray. I had read about the thing. It was not new to the world, but it was decidedly new to me. It was some three or four months after the discovery was announced that I had an opportunity of trying the experiment. A boy had a bullet in his hand which the doctor asked me to locate. I had no faith that I could help the man, but I exposed for that bullet something like one and one half hours. When I took the plate into the dark room it was with a strange kind of a feeling, and when I saw the outline of the hand, and afterward that of the bullet, I can not put it into w rds how I felt. I just felt a certain degree of enthusiasm, gladness and joy beyond expression. Why should not our boys and girls, even if they have an idea what to expect, enjoy the work and get out of it the same degree of satisfaction that I had, or those have who do entirely original work?

Prof. N. A. Harvey—I have been very much interested in the discussion and very much pleased with the paper itself. There is one idea in the paper that leads me in a direction that I am very glad to go—the use of the term research to mean not the extension of knowledge that the world already possesses, but the extension of the pupil's own knowledge after the manner that research workers employ. Generally we think of research as being that kind of work which extends the limits of knowledge possessed by the world. I do not know that this use of the term research is above criticism. After all, it carries with it an implication that is very good. It seems to me the only true method. Perhaps it has to come to high school work through that word so common and familiar to us, as applied to workers in universities and great original investigators.

It seems to me it is the only way in which we can do the best work for our pupils in the teaching of science. It is not sufficient for a pupil to work for a known result, as that will not afford the greatest advantage to the pupil.

You know how great the influence of expectation is on an anticipated result. When a person is working with a chemical balance, and the operations are not very delicate and he knows he ought to get a certain number of grams and milligrams for a particular amount of substance he has been working with, it is almost impossible to keep that balance from working out the known amount. It shows that result every time. So in operations for measuring falling bodies, if a person knows he ought to get about a specified amount, he can not prevent it coming right to that point. It will come in spite of himself, and he may be as honest as he pleases. It is that influence which is so disastrous to good work. I have no doubt that a great majority of pupils would prefer to know what they would get. I think if the teacher should put it to a vote, "Now, shall we read this Latin lesson with a pony, or read it without?" I think I know how that class would decide. It would be a very remarkable pupil who would take the other stand conscientiously. There are pupils who, in geometry, will work out demonstrations in an original way and not get help, but most will not do so. They are not remarkable. They are common, everyday people like the rest of us. Not many of us will work out a problem at firsthand. We wish to economize time and effort.

I will say this in answer to a gentleman over there. I have had some experience in doing this in work with classes in physics and in chemistry and in zoology particularly, and I might say in botany, where my effort was to an extent that I thought necessary, directed to keeping reference books, textbooks and answers out of the hands of the pupils. The results were eminently satisfactory to me, and I think, to the pupils. I do not know that they enjoyed it more than they would the other way, but they just took it as a matter of course because it had to be that way. There was a very great difference in the kind of work done from that done where a textbook was put into the hands of the pupils. I have in another place presented this instance as an example of a general principle. It is the clearest evidence I know of. For three successive years I taught two classes a day in physics in a normal school, in which the students had had different experiences before entering the school. One was a class of high school graduates, all the members of which had studied Avery's *Physics* and had various experience in laboratories. Laboratories had not been of the same kind. Some were good and some bad, and perhaps some had not done laboratory work. The other class had never studied physics. The two classes were taught in the same studies, with the same experiments in laboratory, and the same teacher. There was the best possible opportunity for comparison, where every other variation was eliminated, it seemed to me, except the one of previous different experience. In a part of the work the experiments and exercises were just as new to those who had studied physics as to those who had never studied it, but this seemed to make no difference whatever. I very soon found that those who had not studied physics before had a better result than those who had studied, and in seven cases out of 10, the class who had never studied physics obtained more nearly accurate results on the average, than those who had studied it. The textbooks were kept away from the students who had studied physics before, yet they certainly had a knowledge of what some of the answers should be. The only interpretation I could make was that the teaching of physics to those pupils with a textbook in hand had detracted from their ability to obtain correct results by their own original observation at firsthand. Proof of the same fact would be more difficult to obtain in botany and zoology.

It seems to me the paper has stated the profoundest principle of pedagogy in teaching physics. I don't know very much what good we are going to get out of it, if not that.

I would like to ask the gentleman who spoke about examinations, what kind of examinations to give. I am very much interested on both sides. I happen to be teaching classes that undergo examinations. I happen also to be on the examining committee for Chicago which examines applicants for entrance to the normal school, for principals certificates and for high school teachers, and the committee has debated seriously for the past six weeks, twice a week, what kind of an examination to give. The difficult thing is how to test the power; the results that accrue from laboratory work and which could not be obtained from textbooks. Last June 385 were examined for entrance to the normal schools. When the number is smaller we can take them into the laboratory.

Inspector Clement—I don't know that I can answer the question better than to suggest one or two questions. Suppose we wish to test the pupil's power to observe. Let the student take any flower he chooses, but state in good English how some flower he has studied carefully is able to prevent self-pollination. If he were given a flower he had not observed it might be tyrannic, but let him have a choice. I think that is fair.

Prof. Grout—I don't want to crowd myself on the association, but I want to give just my idea, that I may not be misunderstood. Mr Clement's statements are right as far as they go. The larger part of the examinations still test the memory. Take the question of the flower's self-pollination. What will prevent the child having that drilled into him? Give him a flower and let him tell how it is pollinated.

I realize the laboratory difficulty. What is there in it? It may be difficult but in so far as it is possible, it is my idea of an examination.

Prof. Samuel J. Saunders—I think it will work very well with older ones, but not with children 14 or 15 years old. There is not time to think it out. It will not work with young people in their teens.

Prof. Albro D. Morrill—In teaching biology, I try not to make the examinations wholly examinations in memory, to test not what he knows, but what he can do; to give the pupil a flower which he has not seen and ask him to describe it. I make the memory part of it shorter on the count, give no directions, but simply ask him to make a complete description of it. In some cases I have had very fine results, but not in all. I think I am testing what the pupil can do, and would mark him low for not being able to do.

Prof. Grout—I have tested that in examinations; you have to make the examinations shorter.

Prof. Harvey—The contention is that the student should do his very best work all the time. His results should be the best that he can get. It may be that he has obtained a totally wrong result. That will be corrected and revised when the work is reviewed by the class as a whole with the teacher. The average result of all the members in the class will come pretty near the truth, near enough to indicate the laws.

Prof. Saunders—It came to me when the gentlemen were discussing the values of different methods, one thinking the result should be known and others, that it should not be, the statement that I have seen made that Prof. Tyndall once called Faraday into his laboratory to show him some experiment in polarized light. As he was about to proceed Faraday stopped him and asked what he was to look for. Even this prince of experimenters thought it would be a help to him to know what he was to look for.

In the x-ray experiment spoken of by Prof. Turner of Buffalo, he knew what to expect and what to look for if all the steps were right. The joy came from the fact that all the steps were taken properly.

I think on the other side, answers should be, as far as possible, kept away from the students. I incline to that method. Keep away results entirely till after going through the process, and then compare them with and look through those of others.

Friday afternoon

GENERAL SESSION

THE STUDY OF TYPES

ITS SIGNIFICANCE AND ITS APPLICATION

PROF. N. A. HARVEY, CHICAGO (ILL.) NORMAL SCHOOL

I assume as the basis of this discussion that the teaching considered in this paper is educational in its nature rather than professional. I mean by this that it shall be for the ultimate purpose of training the mind to do better the things that all minds can do in some degree rather than to accumulate a fund of information to be used in the practice of a profession. The psychologic movement of the learner rather than the logical development of the subject is the thing that is of the first importance, and is the chief factor in determining the method to be employed.

Permit me to state also, that in all my illustrations I have had in mind the teaching of science in high schools. If the teaching of scientific subjects in colleges and professional schools were to be considered, the illustrations and the basic propositions would need very considerable modifications.

The greatest contribution of science to education is the scientific method. The scientific method is not a method of teaching, but it is a method of thought, and is capable of universal application. It is called the scientific method because it has been developed chiefly in scientific subjects by scientific men. Its importance is so great and so fully recognized that we are continually finding the scientific method applied to subjects formerly considered most remote from scientific facts.

In its essential features, the scientific method proceeds in an orderly way from the study of an individual to related individuals. By a comparison of the resemblances and differences existing among individuals, the concept of a class is formed, and thereafter related individuals are grouped into the classes previously formed. By this process we are compelled to recognize the logical sequence and the relative significance of each before we can classify it.

It will be seen that in the scientific method of study, the individual is the first thing to be considered. From this fact the scientific method is sometimes regarded as an example of induction. In reality the scientific method is quite as much deductive as it is inductive, but the starting point is the same as in a case of pure induction. This individual which is taken as the starting point may be called a type, since it always embodies the characteristics of the group that is founded on it. A type, however, may mean much more than the individual that is studied. It necessarily involves all the characters that enter into the concept of the class, but it should be one that contains the average characters of the class. Individuals of the same kind are not all alike; variations occur that make them individuals. These variations are quantitative in their nature, and in some individuals are much greater than they are in others. In any group of individuals that are combined into a class, there will always be extremes of variation and an average point or norm from which variations occur. In the vicinity of this norm will be found the greater number of individuals that constitute the class. It is this average, this point of departure, this possessor of the common characters in the least variable degree that may stand for the type of the class. It will be seen that the selection of an individual to stand as the type of a group is a matter demanding considerable care. It would be very unwise to select as the type for study one of the most aberrant or divergent forms in the group.

It is evident that the selection of an individual to stand as a type will depend on what it typifies. An individual is not a type unless it stands in the mind for a class, or stands as the representative of a group, all of which have common characteristics.

We come at once, then, to classification as an element in scientific study. Classification is implied in almost every operation of the mind above the simplest. It is implied in every act of judgment. Whenever we use a common noun we make use of classification or its result. Every catalogue, every index, every table of contents, the arrangement of our houses and streets attests the necessity we feel for classifying objects. It is a universal process of thought and is common to all human minds. It is this process of classification that constitutes science and makes possible scientific knowledge.

Classification of a series of objects is the actual or the ideal arrangement of those that are alike together, and the separation of those that are unlike. It enables us to do two things. First, it enables us to retain in mind the characters of many objects at once, as well as to infer from things known unknown correlative properties. It is a labor-saving process. It conserves mental effort and this economy of mental effort is perhaps the most important principle in education. It is the thing that largely constitutes the difference between a mind of great power and one of little power.

But classification does more than this. Classification discloses to us the correlations or laws of union of properties and circumstances. It is only when we make a proper classification that these laws appear. We are inclined to think that for every series of objects there is one system of classification that is best, and which we call the natural system, and much energy is devoted to the discovery of that system. The so called natural system of classification in animals and plants is a genealogic system intended to show the relationship by descent of the individuals classified. It discloses the general law of descent and the kinship existing among the different animals and plants. This system is not yet complete, as we do not know enough about animals and plants to adjust them satisfactorily in their places. But there is no question that the arrangement of organized beings in the natural system of classification has been productive of the greatest good in the development of our scientific knowledge, and in disclosing some of the most important and far-reaching truths.

But the natural system of classification is not the only one that may be used to advantage, nor the only one that is still employed in classifying animals and plants. Other systems of classification disclose other laws than those of descent. We still have and still need the classification of geographic regions, of temperature zones, of life habits, of geologic horizons, of physiologic functions. Each of these classifications is necessary and will always be used because each discloses natural laws that constitute an essential part of scientific knowledge.

I think I do not overestimate the importance of the study of classification as an element in education. There are certain elements of dynamic thought involved in classification that are positively fundamental. Somewhere in the life of a student there must be a place where the processes and methods of classification are consciously worked out. If this can be done in one or two subjects, the principle of classification can be applied to other subjects, and be used as a tool to make further acquisitions of power in other directions.

Botany and zoology are the classificatory sciences *par excellence*. Here the principles of classification have been worked out with a fulness of detail observed in no other subjects. Here if anywhere the student must get his knowledge of those principles. In my opinion, botany and zoology must rest their claims for introduction into a course of study largely on the fact that they are classificatory sciences. Any attempt to substitute some other element than classification as a basis for the work in these subjects, is to discard an element of greater importance for one of a less.

I am not unmindful of the fact that both subjects include many departments in which the element of classification is not at all the conspicuous process. Such are the departments of physiology, histology, cytology, paleontology, embryology and ecology. Each of these may be taken as the basis of knowledge of animals and plants. My contention is that in an elementary course, where the purpose is purely educational, it is highly injudicious to make anything but taxonomy the basis of the work. The other departments are tributary to this and should be so recognized. They are highly specialized departments, and can scarcely be studied in their full significance without some knowledge of the taxonomic relations of the forms used as types. I would take taxonomy as the basis and group around it the essential features of all the other departments, not by any means omit them.

This digression on classification started from the statement that the selection of a type depends on what it typifies. In botany and zoology we have classified groups of different rank, rising through the series of individual, species, genus, family, order, class, branch and kingdom, each with many subdivisions. In beginning zoology, some teachers prefer to begin the subject by studying a grasshopper, crawfish or snail. Others looking to the logical development of the subject, prefer to begin with a protozoon: a paramoecium or amoeba. The reason for the latter preference is that the amoeba is a simpler animal. Looking at it from the standpoint of the pupil who is beginning the subject, it seems to me to be not so. To the pupil the grasshopper is the simpler animal. Smallness is not an evidence of simplicity. To the pupil the grasshopper is the simpler form, because it is more nearly related to the things with which he is already familiar. He is familiar with his own body and organs and their way of acting. The grasshopper has legs and it moves. It breathes and eats. In fact it does many things that he himself can do, and in so far is closely related to himself. It is nearly enough like himself to cause him to feel the similarity and yet sufficiently different to enable him to state wherein the difference exists.

The same thing can not be said of the amoeba. The pupil has no body of related knowledge that can be used in its study, but it stands alone and unconnected in his mind. The development of the subject from the amoeba as a type, does not follow the historical development of the subject, and though this is not necessarily the best method of procedure unless the historical development of the subject follows the psychologic development of the pupil, this latter is likely to be the case and the historical development of the subject is likely to indicate a logical and psychologic method of introducing the pupil to the subject under consideration.

There are many advantages in beginning the study with an insect or crustacean, such as convenient size, its economic importance, etc. But I have introduced this example to show that all such considerations mentioned really have little weight in deciding on the selection of a preliminary type. We must answer to ourselves of what it shall be a type. A complete scheme of systematic study would lead us to select a type of a species, a type of a genus, a type of a family, a type of an order, a type of a class, a type of a branch and a type of a kingdom. The logical sequence and relative significance of these groups can be determined only if our first animal studied shall serve successively as the type of each. By this process we begin with the individual as an individual and rise by successive generalizations through the less extensive groups to the all-inclusive group of animal kingdom. I know of no one who will undertake, with a high school class, to use an amoeba as a type of a species, a genus, a family, an order, or even a class. It is generally used as a type of animal that is of a kingdom, thus beginning with the most extensive group and proceeding in a deductive order to less extensive, or not obtaining from the subject the content that I should suggest as one of the most important things to be obtained from it, viz, a knowledge of the principles of classification and the full significance of type study.

Besides this, we must decide what an individual shall be a type of before we can decide what characters are of sufficient importance to demand the attention of the learner. An animal or whatever it may be, is at first only an individual, and as such has some thousands of characteristics of which no one will be rash enough to undertake to make a complete catalogue. Different writers of laboratory guides will cause a pupil to see different numbers of these characteristics, some more and some fewer. A college student will be called on to see 50, and a pupil in the grammar grade to see only five. But on what basis is the number of characteristics to be observed determined? There is scarcely more value in seeing 50 than in seeing five unless the characters to be observed are selected with a reasonable and sufficient end in view. To add to the observation of nonsignificant characters the observation of other nonsignificant characters is an unnecessary waste of energy. They will never become significant.

If we study the grasshopper as the type of a species, we shall notice the carinae, the fovea, and various other things that discriminate one species from another. If it is to be used as a type of a genus, we shall necessarily notice the generic characters: the subgenital plate, the fastigium of the vertex, the prosternal spine and all the other marks by which systematists distinguish one genus from another. In a complete scheme of type study, it seems to me that there might properly be this minute discrimination of characters till the idea of the less extensive groups has been built up.

If our grasshopper is to be used as the type of a family, we shall be called on to see the various family characteristics: the wings, the legs, the ovipositor, and the shape of the body. If it is to be used as the type of an order, we shall notice the ordinal characteristics: the mouth parts, the kind of wings, the metamorphosis. If it is to be used as the type of a class, we must observe the class characters: the body divisions, the number of antennae, the kind of skeleton. If we make it the type of a branch, we must observe the things that separate the branch Arthropoda from the other branches, while if we are to use it as a type of the animal kingdom, it will be necessary to observe independently the things in which all animals agree and in which they differ from all other created beings.

I trust it will be seen that we have here a means and a reason for deciding on the particular characters that are to be observed by the pupil who is put into our charge. The reason for directing him to such study as will lead him to see these things rather than to see others will not be apparent to the pupil, and I am sorry to suspect that it is not always apparent to the teacher as well. But it is our duty to find the reason for doing as we do or not do it.

I have stated now what a type is, and the principles that shall govern both our selection of the type and the characters to be observed in the study of each. My second proposition is that different things selected as types should be related to each other in such a way that the comprehension of the relations shall not be too difficult for the learner. The types must not be too widely separated from each other and the related forms must be studied. If this is not done there is little value in the study of a type. All thinking consists largely in the perception of relations between things. So numerous and so diverse are the relations existing in the universe that we may say that education consists largely in training the mind to perceive relations. Any mind can perceive some of the most evident relations, but the mind of the greatest philosopher is incapable of recognizing some of those that exist. In order to train the mind to perceive relations, it must be set to perceiving them, and the difficulties must be graded according to the capacity of the mind to be taught. It is in the proper gradation of difficulties that teachers are likely to make mistakes, specially in the teaching of science whose pedagogics is so insufficiently worked out. We have no adequate statement, so far as I have been able to find, of the psychology of laboratory science, and no serious attempt has been made to frame a course of study in science in terms of the psychologic movement of the learner. Our books of method in science are books of devices, or methods in the most limited sense.

Returning to our example of the grasshopper, we have observed the characters that we shall use in studying other animals. We are then ready to take up the study of a related animal. Ordinarily we seek for the type of a family rather than the type of a species or a genus. By a comparison of the representatives of different families that are closely related, we can generalize from a statement of their resemblances and differences, and rise to the concept of a larger and more extensive group. Families that are alike make up an order, so we can obtain the concept of an order from a comparison of the types of families. Next we select types of orders and so rise to the concept of a group of higher rank, in which different characters are employed, and are thus seen to be of deeper significance. In a similar way we can obtain in succession an idea of a class, a branch, and a kingdom. If we wish to go into more minute discriminations, we shall be able to reach the conception of each one of the 21 divisions that have been used to designate the successive including groups employed to express the relationships and sequence of animals.

In all this work, our first type may be used as the type of each successive group of increasingly greater extension, for our observations originally included all the characters of the successive types. Successive generalizations separate the table of characters into an increasingly larger table of differences and a decreasingly smaller table of resemblances between the animal first studied and representatives of the more extensive groups. Finally our entire table of characteristics will be seen to be distributed into the successive tables of differences. This process has enabled the teacher to cause the mind of the learner to move in such a way that the relations of the different animals studied have been clearly seen. The mind has been compelled to discriminate, compare, and generalize. Our selection of types has led to this result.

I would not have it understood that we study only the dead forms instead of the living beings, as is sometimes charged against this kind of work. The living activities are just as much a character of the type as the morphologic structures. But the dead body of a beetle is a living thing in the sense that every part has been produced by the life of the animal, and had some function in the life that the animal lived. We study the legs because the animal moves with them; the wings because he flies with them; the mouth parts because he bites with them. And so it is with every part; each part has some meaning in the life of the animal and it is the object of study to interpret that meaning.

Just here I should like to pause long enough to comment on the value that exists in systematic work in botany and zoology. It is a kind of work that has of late fallen very much into disfavor, and very properly, too, in consequence of the great abuse to which it has been subjected. The marks that are used to discriminate genera and species are apparently so trivial that they seem ludicrous. I would merely suggest that the variation in physiologic function and life habits is usually much more pronounced than it is in the morphologic structures. But the differences in morphologic structures can be quantitatively stated and used to discriminate species. Even among individuals of the same species such variations in personality exist that we need to study many individuals of the same species in order to obtain an insight into the psychology of the mind of the species. Also, I would suggest that all the most delicate work of the embryologist, the histologist, the ecologist, everybody who contributes to the knowledge we possess of an individual of a particular species, only helps us to arrive at a better understanding of the relationships that exist among the various groups of animals and plants, which is precisely the thing that the systematist attempts to do in a rough and ready way.

My third proposition is that the study of types is necessary for the purpose of economizing effort. This is merely a corollary to our discussion of classification. I doubt if there is a more important principle in education than the one indicated by the phrase, economy of effort. I believe that it can be shown that the essential difference between the great intellect and the common one is embodied in the phrase, economy of effort, and that the most important mental processes are those that most efficiently conserve mental work.

A type from its nature stands for a class. Everything that we may predicate of the type as distinguished from the individual, we may predicate of the class. We need not then examine all the members of the class in order to know what its properties are. Type study is a substitute for perfect induction, and while it has serious limitations, its advantages are very great in the economy of effort. The great extension of knowledge in every direction has necessitated a development of some method of using it. Otherwise it becomes unwieldy and a student is overwhelmed by its very profusion. Type study is the method by which this great wealth of knowledge can be acquired and made available for service.

The idea of a group that will include the various individuals studied is obtained by a comparison of their properties and selecting from the entire number those in which the individuals agree. The concept of the more extensive group is obtained by observing the resemblances that exist among the types of the less extensive groups. This process is called generalization, and is of essential importance. In fact, most of the other operations of the mind may be regarded a tributary to this one function. It necessitates a good many preliminary operations: abstraction, analysis, discrimination and comparison.

The perception of resemblances is a more difficult process than the perception of differences and manifests a higher order of thought. There are acute minds that have in a marked degrêe the power to see differences, but whose ability to see resemblances is exceedingly limited. In order to generalize we must often see a logical identity existing in objects that on first examination appear to be wholly unlike. Paradoxes are fused into a unity, and things that seem to be so diverse as to render the assertion of their identity absurd; are seen to be essentially the same.

Every mind must generalize, and has the power so to do. But the differences in this power possessed by different individuals are very great. It is a power that can be exercised safely only with much caution and after long training. Every great advance in thought has followed a wider and more far-reaching generalization. Those who are capable of making such generalizations are the philosophers and leaders of thought. In natural science we are taught consciously how generalizations are made and the necessary cautions to be employed. Science, then, is the great training ground for those who generalize, and from the ranks of scientific men, or those trained in scientific methods, the philosophers of the future are sure to come.

In the collection of material, the mind becomes buried under a mass of details. We must select out of this mass particular things that we can examine fully, and generalize from them. The selected forms are types, and their inspection is necessary to enable us to generalize.

My fourth proposition is derived from the third. Economy of effort is obtained by comparing the second type studied with the first. It will be remembered in our previous illustration that the elementary type, or the first form studied, was examined as an individual. There is no economy of effort if the second type is studied *de novo* in the same way. It must be studied by comparison with the first. Ordinarily, its individual characters need not be noticed, but only the specific and generic characters. That is, the characters that are like or unlike those selected for study in the first.

The former practice in beginning the study of botany was to learn lessons from Gray's *Botany*, and after they had been well memorized, then to go to the flowers and apply to them the names of the parts that we had learned in the lessons. That is the way that I began the study of botany. While I have a profound respect for Gray's *Botany*, I have not so much for the teachers who used it in that way. They failed entirely to grasp the significance of type study.

Suppose that we decide that it is a proper part of botany to study flower structure. If one of the buttercups is available, it will serve well as a type. A short time will suffice to fix the fundamental characters of this flower. The evening primrose in the next lesson will embody the same essential elements of flower structure with modifications, the most important of which is the fact that the ovary is compound. The compound ovary is about the only thing in the flower that must be learned new, and this is learned because it is a difference from the type form of flower previously studied. A study of the jimson weed will introduce us to the monopetalous corol; a clover to the papilionaceous corol, the diadelphous stamens, and the clustered head. Other ideas in flower structure can be simply exemplified by a proper selection of types, so that 10 lessons treated in the most economical way will give the student a better idea of flower structure and plant morphology than we obtained in three months in the old way.

It was formerly the custom, now happily abandoned, in studying flowers to have a series of blank forms with many descriptive words, and the pupil was expected to underscore the words that fitted the flower he had in hand. You will see that in this process each flower was studied by the same pattern that the first one was, so that there was no economy of mental effort, though there might be a saving of ink in consequence of not having to write the descriptive words.

By the use of properly selected type forms, it is easily possible to study a dozen related individuals with no more effort than it took to study the one used as the original type, and do it as well. I have often observed that a class in the first year of a high school course will learn as much about a cricket, see just as many characteristics and see them just as well in two days as they saw on the first specimen studied, a beetle or a grasshopper, in five weeks. A common explanation by unthoughtful persons is that the powers of observation are cultivated by the study of natural science to such an extent that they have become able to see more in a given time. The power of observation as a reason for studying natural science has been so much overworked that I always feel suspicious of either the knowledge or the sincerity of anyone who gives that as a reason why natural science should be studied. The power to observe comes largely from the related facts previously known.

My fifth proposition is that type study is almost universal in its application. It is a conspicuous feature of the scientific method, and is capable of application with all its advantages wherever the scientific method can be applied. I have been using illustrations drawn from the classificatory sciences, but it is now being applied to geography in the series of books of which our friend Dr McMurry is one of the scholarly authors. In sociology my friend Mr Thurston is enthusiastically using it as a great improvement over the former method. In literature we see the same thing in progress. Everywhere we see the same tendency manifested. In fact, type study is not a thing just newly discovered. It is a very natural thing and has been employed deliberately many years. It is only recently that we have awakened to its full significance and have begun to inquire into its real merits and to study the laws that determine its use.

There is one other consideration that ought to be noticed. Type study presupposes that an individual is the center of correlation for all the characters that pertain to it. Now suppose that we had all the observed characters of one type written in a vertical column under the name of the type. Beside it we have the name of another individual or type with all its characters written under its name. Similarly suppose that we have the observed characters of several or many types written under their respective heads. Now shall we study our tables vertically or horizontally? Shall we make the type individual the center of correlation or shall one character expressed in the table be the basis of our study? Shall we study how the bumblebee lives and moves and has its being, what organs it works with and what kind of a creature it is, or shall we study how animals defend themselves and notice the bumblebee's sting as a defensive organ? The latter practice is directly opposed to type study. The advantages of type study are so pronounced that I have no hesitation in saying that the individual ought to be made the basis of study, but, in consequence of the natural disposition of people to run after strange gods, I believe that many people overlook its advantages and try to make an abstract principle the center of study. I grant you that these generalized principles must be known, but they become known so easily and with such great educational benefit when several types are studied and compared, that it seems to me a serious matter to abandon type study and make generalizations already worked out the basis. Such things are very well for newspaper science and cheap magazines and popular lectures, but they can never constitute the core of a scientific education.

Dr Grant Karr—*Mr Chairman, Ladies and Gentlemen:* We have listened with great interest to Mr Harvey's paper. I have enjoyed it to the extent that my knowledge would allow me to grasp it. I appreciate the fact that Mr Harvey is a specialist in his line, and this paper is one we will read with pleasure and profit hereafter. It seemed to me very difficult to get hold of it as he read it, and since I did not have an opportunity to read it and did not feel disposed to prepare a set paper and go off perhaps on a different line of thinking from that which Mr Harvey would take, my preparation is not very extensive, and what I have to say will be more in the line of suggestions, that have occurred to me and will pertain more to the teaching of science in grades below the high school, those being the ones with which I am most intimately acquainted.

The paper impressed most deeply some suggestions made this morning in the paper read by Prof. Saunders and its discussion. The first question which occurred to me was this: What is the relation of scientific knowledge to practical life? That is to say, what is science to do and why are we teaching science? Is the mere knowledge of scientific facts the end and aim of science teaching? That of course would bring up the whole discussion that arose this morning regarding examinations. There is a pretty well settled notion in the minds of many that an examination in any subject finishes it, and any preparation, in science or anything else, that would enable one to pass an examination, Regents or college entrance, suffices and that the passing of such examination *closes* the case.

Prof. Harvey in several places intimated that his solution of the question would be somewhat different; that he would have a knowledge given in science that is not of the sort that can be exhibited in answer to certain questions, a knowledge deeper than that, a knowledge that enters more deeply into the thinking, feeling and willing of a person, like the knowledge that was referred to this morning by the gentleman from Buffalo when he was first successful in making a photographic plate by means of x-ray, of a bullet that had lodged in a person's hand.

I would be glad if someone would discuss more fully and throw more light upon Prof. Harvey's treatment of this phase of the subject. It seems to me that the thought underlying his discussion more than anything else was that of the laboratory as a means of giving the student the requisite experience as a basis for thinking, doing and living. His first statement was that he wanted to call attention to those things which all people do, and which only the few do consciously and with a goodly degree of accuracy. The scientific method has come to stay and is a necessary part of the equipment of all who expect to understand the life and doings of the 20th century. The idea of evolution has come into the world and is influencing all sciences and all phases of life whatsoever, religion, literature, history and everything else. Someone has said that the two ideas of sociology and evolution are the two ideas by which we measure the present. They are the dominant ideas which define the present. Everything is filled up with these ideas. They are treated of in science and the scientific method is permeated with them so that one of the results of science teaching, as Prof. Harvey says, should be the acquisition of skill in the use of the scientific method.

What Prof. Harvey has said regarding the nature of classification strikes me as very excellent indeed. The nature of generalization and classification is best understood in this relation, types and type study being their less complete form, a sort of going from the less intricate into the more intricate and abstract ideas which the cut and dried statements of the science books give us. It seems to me good for us to have our attention called to the fact that there is no absolute knowledge on science, or any subject, for that matter. This "big buzzing blooming world" exists everywhere, varying in clearness and confusion, in every kind of knowledge as in science, and the study of types is a natural way of approaching to a more or less complete comprehension of it, more perfect by far than out of a textbook.

The study of types, it seems to me, is also the natural approach to the gaining and organization of knowledge, that is to say, it gets at the general idea tentatively in each animal or in each species of animals, which underlies a certain class and their functions. Types are a sort of nascent generalizations.

One practice Mr Harvey did not mention, that is sometimes to be found among science teachers, in the lower grades specially, is that of treating science or nature facts as a hodgepodge of isolated sensuous phenomena. That is to say, the experiences of the pupils are a sort of fireworks, a series of sensuous experiences the relations of which remain for the most part unemphasized and undiscovered. Such work is utterly unprofitable. A certain amount of classification must enter in if the work is to be valuable, no matter how elementary the grade is in which nature is taught. There must be some classification, varying with the maturity of the students, of course. A few characteristics seen together form a type. That is the way mind works. The mind can not make any movement at all without making a judgment, always something is something, the less general often the more general. It is the "logical way" which the mind always has. The study of types takes into account the mind's natural way of moving. Hence its excellence. Study the cat. One of the good things is to call attention to its definition, perhaps ask the question, "What is a cat anyway?" There comes in the necessity for a loose classification, the formation of a type. One can not tell what a thing is in any way without relating it to something, and so the type becomes a nascent generalization. I have tried the experiment several times in all grades. There was much difficulty at first in defining the thing, but yet a welcome difficulty because it appealed to power in a natural way. If attention has not been called to it before, it makes the subject more interesting than it otherwise would be.

Oftentimes, always in the higher grades, one has to take into account the experience the people have had who are being taught, and give the experience, put the people through a course of living before they get anything to classify, in the form of types or otherwise.

As to the newness of type study, I suppose that people who have studied, who have gone into the make-up of things, have always been driven of necessity into the study of types, and that with the rise of the study of natural science this type study has become more and more prominent. The rise of evolution at the close of the 18th century, for instance, gave it more prominence, and led to a new reformation. The facts that Aristotle began classifying and his nomenclature of science were only type study in the light of 20th century science. The classes of Aristotle and those who preceded and followed him were really a sort of world historical study of types. One might call every outlived scientific system of classification a fossil system of types, e. g. the systems of Linnaeus, Cuvier and others.

One more point that occurred to me here in this connection was in regard to the nature of knowledge. It is often regarded by many, and I think that most of us who are engaged in teaching are often haunted with the assumption that knowledge exists somewhere outside of us and it is talked about as if its facts could be gotten out of a textbook or laboratory and placed in the mind analogous to the way in which physical objects might be gathered and dumped into a receptacle. This is an utter failure to understand the nature of knowledge, and such a view, if one has it, is sure to result in more or less superficiality. Knowledge is not a thing that can be " put in " by the laboratory method or textbook method. It must be produced inside. The theory side of the idea is not all there is of it. The mind is more than ideas. There is action and feeling. If the other side of the knowledge is not there, it is an empty knowledge. The laboratory will enable one to take on more of this external knowledge than the mere textbook, but yet it seems to me that the laboratory should be used to widen the whole experience of a person, to give him deeper insight into the life that he has lived and at the same time aid him to live a larger and fuller life. The laboratory is one of the most potent factors in the progress of the last one hundred years. But would it not be still more powerful if it were brought into closer relation to the other sciences and life itself? Are not the laboratories themselves too often satisfied with mere knowledge as a result? "Life is more than theology (theory) and the people know more than the preachers (whatever method they may have) teach," says Emerson. But this brings up the whole question of the subconscious in our life, and its understanding involves a full discussion of epistemology and its bearing on practical life.

Prof. C. W. Hargitt—I have been interested in the presentation of the paper, and while not caring to enter on its discussion at this time, thought, however, I should like to ask Prof. Harvey a few questions. I don't know that they would be profitable questions here, and yet they may: whether pedagogically speaking he should consider the type method of approaching the profounder or broader subject of taxonomy, indispensable in all grades of work. I suppose that if we were to speak of it from the high school standpoint alone, and I think that was his point of view largely, there might be some fair unanimity of thought. If we were to speak of it from the point of view of the grammar school teacher in the sort of work the grammar schools are able to do which we recognize under the head of nature study, might not something very different better serve the aim of science work, and when we come perhaps to pass into the more intricate problems of morphology and embryology in the college course, might there not be some differences of opinion, honest and serious, as to the type method? After all, it seems to me that more will depend on the individuality of the teacher than on the method. Let the teacher possess himself or herself of an ideal and a purpose and it makes less difference what the method may be. There may be very little of method in certain cases and yet admirable results. I thought this morning during a part of the discussion, when it was stated that an expectation of what was to be found in the dissection of animals gave zest to the dissection, that such was the method of no less distinguished a teacher than Huxley; and Huxley's introductory manual for laboratory study continued to be a type of laboratory method for nearly a generation. There has been some wide departure from that method of late, and yet the method that produced the results that were produced through that means is not to be despised. If, on the other hand, we take the other extreme and take Agassiz as its exponent, who, after handing a starfish to a student and letting him work at it, and asking him what he saw went off and let him look at it more, and so on for a day or a week, without a word of specific direction, that is another method.

We need only to refer to the products of the method in the men who have come from Agassiz's inspiration, as sufficient proof of its value. Whether the type method or some other method shall be used depends largely on the temperament and point of view of the teacher; and after all, the teacher is the motor in all this laboratory instruction and in all science work. Were it not so, let us use encyclopedias and textbooks and all that. They are a great deal cheaper than teachers; don't require much apparatus, nor care of apparatus. Let us turn them into encyclopedias and dispense with the live teacher. In the presence of the beginner, the child in the kindergarten, or in the grammar school, or even the boys and girls in the high schools there is something that is fundamentally important in life as it expresses itself, not only to see the form and structure of the thing, but how it acts, to move the leg or wing or jaws, to see it in its natural environment and doing the things that belong to it.

I do not know whether the association want to take time to discuss these questions suggested by the paper, but I would like to know, and perhaps the association would like to know, whether in these three or four grades of science work the type method is the necessary preliminary to all sorts of students.

Prof. N. A. Harvey—The second paragraph in my paper stated that it was written with high school work in mind. If other phases of the work were to be considered it would need considerable modification. This method of type study will be applicable only when the things desired to be obtained from the study are approximately something like what I have suggested here. I do not conceive that this is the purpose entirely nor very largely in nature study work, so called. The use of the term method, we sometimes think, implies some particular process of doing something. That is not the thought in my mind. My thought is that method is not something that can be patented, but that method depends on the content of the subject, the way you wish to make the mind of the child move. In certain schools and colleges, as I look at it, there is an entirely different purpose in view from that suggested. In professional schools particularly, the purpose is to obtain the largest possible amount of knowledge concerning the things that have to be used, in the shortest possible time. Books are used to the fullest extent. Books, lectures, laboratory, travel and anything that can conduce to the rapid acquisition of knowledge is to be used to the fullest extent. The college student in most cases is beyond the stage of developmental work that I have described here. He may be considered as having passed through a large part of the work. If not, he is a preparatory student and not a college student in the legitimate sense. He approaches the second phase of scientific study, which is largely a reading phase. He wishes to become familiar with what other people have said and done in the work engaging his attention. When a student reaches the limit of knowledge on the subject, learns to use his tools, knows what has been said and done with reference to his particular field of work, this little bit of the scientific world that he has mastered for himself, he proceeds into original research work and adds to the knowledge which the world possesses. That is the difference as I see it. The method depends entirely on the movement of the mind that the teacher or the instructor desires to have the pupil make.

Prof. A. P. Brigham—Not very long ago I heard one of our most eminent physiographers express the opinion that the time would come when we would get the land forms due to river action, for example, as fully classified as we classify the forms covered by the sciences of zoology and botany. I do not agree with that. I do not think the time will ever come, and I pity the teachers and students when it does come. I hold indeed that land forms are capable of a good measure of classification. Dr McMurry would tell us of his use of types in geography. I will make a suggestion or two. One form of the land is known as a mountain. How would you teach what a mountain is? No definition would cover mountain, so I am inclined to think we would have to begin with the study of types. We can not bring mountains into the schoolroom. If I could have my way, I would bring over the Jura as a type of folded mountains, not much worn, as the simplest type of the mountain form with its foldings, and see how these are made, and then compare the Appalachian, I mean in the narrower sense. I leave out the Adirondacks, as their structure is hypothetic; leave out the Green mountains, taking the simplest part of the Appalachian system as found in Pennsylvania. Then I would give a great deal of time in comparing the old and worn out Appalachians with the Jura.

If I were in Denver, I would begin with the great western system, taking the Rockies for a start. Teach the Rocky mountain structure as it is known. Go on to the Wasatch mountains or take the Sierras and Coast range, associating the plateaus with them. The order would not be very essential, but we can all see that, as we have passed from one mountain group to another, we should be saving time in all cases, and come out with some kind of a definition of mountains.

There would be other forms of the land, giving the same rational use of types. Let us take volcanos, beginning with

Vesuvius. That is as good as any. Learn all we can about it, and then we may take up almost any other in comparison, Etna for example. Then go over to Hawaii and note the differences in lava, form of cones and manner of eruption. Then pass to other types of volcanic activity.

I agree most heartily as to the great saving of time and energy, and on the idea that we come out with good general notions. I am very sure that our principles grow by using the type method in geography.

Prof. Harvey—*Mr Chairman:* I have had my say. I have made my speech. I do not know that I have anything further to add. I stated in the paper that the study of types is not new, but newly applied. I think it is being applied to the study of geology, as Prof. Brigham suggested, in a way that it has not been done before. No one has undertaken very long ago to study the forms of the land as type forms, nor to work out a typical land form. An examination of almost all the geographies at present used will show that they are studying type forms, instead of individual objects without relation to other individuals that may be grouped with them.

I think the study of types is coming to be used in a new sense from what it has ever been employed before. One thing I should like to say in addition, with reference to some remarks made by Prof. Karr. It may be well to state the relation of knowledge to what may be called discipline. It has been said that there is a contradiction in the two terms. I believe that there is no contradiction but a harmonious relation between them. It is clear to me that we may have the knowledge without having caused the mind to go through the processes that result in strength and power, and we may have it without any acquisition of power in the getting, but there can be no getting of power, training, discipline and improvement of the mind without a concurrent gaining of knowledge. An examination, if a teacher chooses to give it at the end of a term's work or the conclusion of a study, tests the knowledge. If the work has been properly done, the knowledge gained may be taken to measure the power that has been gained, though the knowledge and the power are not identical.

Knowledge may be tested without testing the power at all. The acquisition of knowledge necessarily accompanies the gain of power, but the gaining of knowledge does not imply that power is gained in the same process.

Prof. Hargitt—It may be of interest to the teachers of physiology to see some of the experimental work and the models illustrating the experimental work done with the first year students in physiology here. The laboratory is at the west end of this corridor, just opposite the head of the stairs, corresponding to this room, and tomorrow morning, between 9 and 10 o'clock, a demonstration will be made of heart action. Anyone interested in that work will be welcome to see the models and the experiments. They are rather ingeniously arranged, and very strikingly illustrative of certain processes which are not often seen.

Friday afternoon

SECTION MEETINGS

Section A. PHYSICS AND CHEMISTRY

PREPARATION AND TRAINING OF THE TEACHER OF PHYSICS

PROF. CHARLES B. THWING, SYRACUSE UNIVERSITY

There are, I believe, three classes of men engaged in teaching.

First, those who are aiming at some other profession and are teaching as a temporary means of support. I presume that the number of this class engaged in teaching science is comparatively small, and that the number so employed who take sufficient interest in the broader aspects of the teacher's work present today is smaller still. I shall not have them specially in mind, therefore, in what I shall have to say.

A second class is comprised of those who have no special aptitude or preference for any other calling and have therefore taken up teaching. Their idea of teaching is somewhat like the coachman's notion of the episcopacy. "For a nice, clane, aisy job," said he, "give me bishop." I may say in passing for the benefit of visitors who may not be teachers, that the "job" of a successful physics teacher is neither clean nor easy. It means long hours, dirty hands, tired back and weary brain. But to him who loves his work it is a task full of pleasure and rich in rewards.

This leads me to the third class, which, I need hardly say, is composed of men who *could* do other things, profitably to themselves and acceptably to others, but who could hardly be contented anywhere else than in the teaching profession; men who are *called* to teach, called by their inclinations and aptitudes to begin, called by the loving appreciation of pupils and the commendation of principals to continue a work which they find, despite long hours and poor pay, brings them the consciousness that they are doing a work, quiet and unheralded though it be, the influence of which in molding the characters of the rising generation is second in importance to the work of no man, however prominent he may be in the public eye.

For the younger teachers present I shall try, in the time allotted me, to sketch in barest outline the ideal teacher of physics. In the discussion which follows this paper I trust the more experienced teachers will fill in some of the details of the picture till we see before us a composite portrait of the best science teachers we all have known. It will then remain for each of us to compare ourselves with our ideal and devote the remainder of our lives to completing our training and preparation for our chosen work.

The teacher of physics is first of all a man. His first concern for himself is that he may be a clean, honest, upright, manly man, whose interest in his students is not confined to the classroom but includes their sports and recreations, their home life and reading, their other studies and employments. He sees in each pupil, not primarily, one of a class to each of whom the same task is to be given, the same goal set, but an individual human soul, struggling with his own peculiar difficulties, often ignorant of his own needs and limitations, yet always open to help from the man wise and kind enough to see and show him his needs.

To the true teacher his subject is but one, perhaps his best, avenue of approach to the individual student's inner self. It often happens that the teacher's first real approach to the student must be along lines outside the subject taught. Every teacher will bear me out in the statement that he who has once found the way to a pupil's heart can teach him something about any subject which he himself has mastered, however long or deep seated the fancied dislike of the student for that subject may have been.

The youth retains to a large extent that insight which is so marked in young children. He knows his friends. No simulated interest in his affairs, no attempt on the part of the teacher to hide his own defects of scholarship or vices of character can long deceive the pupil. The man who hopes for permanent success by any but the most open, honest methods of dealing would better follow some employment which brings him into contact with grown men whose confidence in their judgment leads them to distrust their intuitions. He who probes men's souls like the surgeon who probes men's bodily wounds must have clean hands and instruments, or he will do more harm than good.

Second, the teacher of physics must have the same qualities which make the teacher of any other branch successful. He must be master of himself under the scrutiny of bright eyes, eager for knowledge or mischief, looking from the same bench with eyes whose attention must be caught and held till the sluggish, wandering thoughts are focused on some worthy object. All that any teacher needs of tact and skill and patience the physics teacher needs, and sometimes, when the apparatus goes wrong and the experiment falls flat, he is likely to feel that the humility of Moses coupled with the patience of Job would hardly be sufficient to preserve his equanimity.

The graces of tidy dress, a cheerful manner and a pure, clear English diction should be his, whatever effort it may cost to gain them.

Again the teacher of physics is a teacher of natural science, and the different sciences have relations with physics so close that it is impossible to ignore them. Indeed if the student has before studied and become interested in another science, the interest already aroused may be carried over to the new subject by an easy transition along the lines of contact between the two. If the teacher knows less of these kindred branches than the student knows, or thinks he knows, there is danger that the student will underrate the teacher's knowledge of physics. If, on the other hand, the teacher is fairly well at home in the other sciences, he can, by skillfully drawn illustrations, bridge the gap from the known to the unknown and lead the student to a firmer footing in the new territory.

I believe no mistake is more commonly or more often made by young teachers than what I may call, for lack of a better term, the error of abruptness. We plunge the student up to his eyes in a flood of new terms, new ideas, new methods of thought and then wonder that he gasps and flounders helplessly about instead of swimming easily to solid ground. We ought rather to conduct him to some point in his present groundwork of facts from which he may pass by easy stepping-stones across the boundaries of the new.

I am sorry for the teacher who is compelled to teach half a dozen sciences at once without time or adequate equipment for any one of them, and yet I am convinced that if the opportunity offered for the teacher who intended ultimately to teach physics to spend a year in teaching chemistry or biology or astronomy or physical geography it would be wise for him to embrace that opportunity and make the most of it. Physics is preeminently the broad or basal science. It now compasses the major part of what was once called natural philosophy and it is still the most general of the sciences.

If we think of natural science as one of the great natural divisions of human thought, physics occupies a mountain range and table-land near the center of that realm. In the foothills, well within the boundaries of physics, lies chemistry, in a territory which remained fairly well defined so long as the physicist kept himself strictly to masses and molecules and left the atom to the chemist. But of late years the chemist has been making incursions into physics till a neutral territory called physical chemistry has been formed. Still more recently the study of Röntgen rays, Lenard rays and kindred lines of investigation have compelled the physicist to believe that the atom is not, in reality the ultimate division of matter, but that the atom itself consists of thousands of smaller particles which Prof. J. J. Thomson calls corpuscles.

The physicist and chemist are, therefore, constantly crossing each other's territory, and he who is the trusty guide in physics must know at least the landmarks in the realm of chemistry.

The ultimate nature of matter, electricity, gravitation and the other forms of energy are the almost unexplored peaks which lie at the center of the field of physics.

Biology is a sunny land lying to southward. Its denizens trace back the streams of life to a point within the boundaries of physics and chemistry and leave us to track them still farther toward their ultimate source.

Geology overlaps with physics on the one side and biology on the other.

All of the sciences are debtors to physics for their instruments of research and all assume the fundamental laws of physics and chemistry for a working foundation, as physics in turn assumes the laws of mathematics. In view of the intimate relations which exist, therefore, between physics and the other sciences it behooves the teacher of physics both to include a study of these sciences in his general preparation for his work and to keep up as far as possible with the progress being constantly made in these subjects.

For the latter purpose I feel hopeful that a publication recently begun known as the *Current Encyclopedia*[1] would be of great value to every teacher. The science department of the *Literary Digest* is exceedingly helpful along these lines, though more popular in character than the first named publication. Both of these periodicals contain, of course, much other matter of interest in other lines than science which for the sake of general culture the teacher might profitably read.

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[1] Modern Research Society, 153 La Salle st. Chicago.

I come now to a matter which may seem to some of you not quite germane to my subject. I am, however, unable to separate it in my own thinking or to keep it out of my daily teaching. I refer to the relations of science to theology. That any conflict has existed between science and religion I do not believe. I can not conceive how an increased knowledge of the laws of natural phenomena can in any wise diminish our reverence for the divine first cause, or lower our ideals of duty toward our fellow man. Indeed I think no thoughtful person ever contended that men of science are less reverent, less law-abiding or less abounding in good will and good deeds to their fellows than are other men.

Science has, however, attacked again and again certain beliefs which were so closely connected with religion in the teachings of the church and hence in the popular thought, that religious teachers took alarm and the truth was in danger of being lost to view in the smoke of noisy conflict. The field of battle shifted from geology when the old interpretation of the meaning of the days of creation had been abandoned to biology, which with the doctrine of evolution struck a stinging blow at the popular beliefs concerning the origin of man.

A question which it is to be hoped may be debated with less of acrimony than either of these because of a growing spirit of tolerance in both camps is the problem of the origin of life. That problem must find its solution, if the solution is found in physical science at all, in the realm of physics. At present the biologist is tracing back one vital phenomenon after another to the point where he can say, " It is explainable by purely physical or chemical processes." Suppose now it be found that the movements of the lower forms of animal life may be induced by electrical or chemical means, and do not necessarily argue an intelligent purpose on the part of the animal to seek its food, does the acceptance of this explanation preclude the necessity for a guiding intelligence in nature?

A recent case in point will illustrate my meaning. It is a well known fact of physics that, while the shape and position of a large body of liquid is determined chiefly by its own weight, the shape and movements of small drops and films are determined almost wholly by what is called capillarity or surface tension, the force which gives the raindrops and the soap bubble their spheric shape and causes the oil to rise in a lamp wick.

Now a German scientist has lately found that he can by whipping soap suds in oil produce a filmy froth which presents under the microscope the exact appearance of protoplasm, the physical basis of life. More wonderful still, this artificial protoplasm creeps and moves about and its individual cells contract and change their shapes and have currents of fluid circulating within them in a manner startlingly like the behavior of protoplasm itself. The so called "life" of the film is about 22 hours, after which it loses its power of motion and disintegrates.

What has the physicist to say in answer to the question, "Does surface tension explain the life of protoplasm?" To him the crucial point of the experiment is its end. The movements of the artificial protoplasm ceased when the energy imparted to it by the experimenter in the whipping process had been expended. It had no power to draw energy from its surroundings and so keep itself alive. If there is one law of more universal application than any other it is the law of minimum potential energy. In accordance with that law all spontaneous motion in dead matter is in that direction which will result in changing its condition from the less stable to the more stable. Water flows down hill, escaping steam expands, complex unstable chemical compounds, such as those formed under the influence of life, disintegrate or decay to stable compounds when left to the unhindered operation of physical forces. The heat of the sun itself is being radiated through space and the sun and all the planets must one day be as cold and lifeless as the moon is now. Nature, so far as physical and chemical laws can determine, is slowly but surely running down to a dead level of equilibrium. For the soap protoplasm there was nothing to do but die. It could not generate other soap protoplasm, nor even keep itself alive. It had no resources other than the mechanical laws of physics, and these, as we have seen, always lead to the same end.

But the plant protoplasm does otherwise, it draws energy from its surroundings and keeps itself alive. It generates other protoplasm like itself and builds up a living organism, differentiated in its different parts, employing the principle of division of labor as if working toward some definite end. It overcomes the chemical affinity of stable compounds in the soil and builds them up to highly complex unstable compounds. It overcomes the force of gravity and lifts a ton of wood a hundred feet into the air, building a tree which lives a century, surrounding itself meanwhile with a whole forest of trees which are, like itself, fighting against wind and flood and the subtle forces of decay. Whence has it the power to do all this? There must be something in or about or with the protoplasm that makes for progress in opposition to the inexorable laws of physics. The question "What is life?" remains unanswered, but the stream of life has been traced one stage nearer to its source with the result that the presumptions in favor of a purely materialistic origin of life are fewer today than at any time in the history of modern science.

But, someone asks, would you think it wise for the average teacher to speculate on these questions before his class? Possibly not; that is a question for each one to decide for himself. The average teacher will have young people in his classes who are thinking somewhat on these questions, thinking oftentimes with the deepest concern, for young people often take the deep questions of life more seriously than do their elders, and those same young people might be greatly helped by a thoughtful word spoken in private.

At all events one thing should be desired by the teacher above all others, both for himself and for his pupils, I mean the attitude of mind which places truth above everything else, that humble spirit which keeps the mind open to truth from every source, that spirit of reverence toward all truth which never scoffs at what it can not comprehend, nor willingly distorts the truth to gain a point in argument. The man who by patient thought and honest life has won his way to such an attitude of mind may never attain a wide grasp of philosophic problems himself, but among his pupils there will arise men whose thought will mold the forces of the world for good.

Last, the physics teacher is to teach physics, a task which requires for its successful fulfilment certain special aptitudes and habits of thought and a fairly definite technical equipment.

Physics is, at least in its possibilities, the most exact of the natural sciences. The phenomena studied admit of accurate measurement and are reducible to laws which may be expressed in mathematical symbols. The physics teacher should have or seek to acquire, therefore, the habit of accuracy of thought. This habit will show itself in speech by the employment of exact terms and by the frequent use of such qualifying words as "about" and "approximately." It shows itself too, in habits of promptness, order and neatness, and in manipulative skill, for the difference between a successful experiment and a failure depends oftentimes on a turn of the wrist, while the ability to give the wrist the right turn at the right moment tells of a habit of accuracy which has taken years to gain.

The physics teacher needs to have a taste for mechanics together with some practice in the use of tools. Few pieces of apparatus come from the maker in perfect adjustment and fewer still will stay in adjustment from year to year. The teacher who can use tools is rich with a very meager outfit if he can command a small fund from which to buy materials, while the clumsy teacher would be poorly off with a costly cabinet of apparatus at his disposal. The fundamental laws of physics are grounded in mechanics and find their illustrations in everyday machines. The teacher of physics should form the habit of noticing machines of all sorts and trying to understand how they work. I spoke near the outset of the opportunity afforded by the student's knowledge of other sciences to introduce him to the study of physics. It often happens, though, that the student has no such knowledge to help him. There are few boys, however, who do not have a working knowledge of some machine and most girls understand the working of the sewing machine at least.

A little broader field of observation and one which the teacher may cultivate with pleasure and profit all his life is found in the daily experiences of common life. A glass of water and a spoon at the dinner table afford illustrations of reflection, ordinary and total, magnified and diminished images by reflection, refraction, magnification by refraction, water waves, sound waves, and many other phenomena, while daily observations of the weather and of the varied out-of-door phenomena which daily crowd themselves on his notice will give the teacher a fund of facts for illustration such as no amount of reading could afford. I call to mind a drawing in a well known textbook of elementary physics which is intended to illustrate the apparent position as viewed by a person in air of an object under water. The man who drew the picture was an experienced teacher of physics, but neither he nor any one else ever saw the like of what he has there portrayed. There are two ways in which the teacher might have guarded against the possibility of making an error of this sort. One is the habit of observation just mentioned, the other is a study of the subject as treated in textbooks of a higher grade than that used in the class. Just here a word of caution is necessary. While advanced methods of treatment are valuable, I may say necessary, to the teacher for a thorough mastery of the subject, he must beware how he presents to his elementary classes any but the most elementary methods. The methods of trigonometry or calculus may appeal to the teacher by their clearness and simplicity, but to the student who has at best but a vague conception of geometry these are an unknown tongue.

The teacher should bring to the class the results of his study, not the steps by which he has reached them. Physics is strong food for babes. It must needs be predigested in the teacher's mind before it can be profitably offered to the pupil.

This work of mastering and simplifying the principles of so difficult a subject is the work of years, and it can not all be done before the teaching work is begun. Day after day, year after year, the teacher must modify and adapt his methods of presenting the subject till he has several good ways of explaining each point all at his tongue's end, and even then he will some day need to extemporize a new way in the presence of the class. It is for such emergencies, the propounding by the thoughtful, observing student of some question which seems never to have been asked before, that the teacher should be constantly trying to prepare.

If to all the qualities that I have suggested the teacher can add the ability for original research, he will bring to his class an added stimulus that nothing else can give. But here, too, let him beware lest he ride his hobby to the detriment of those who need a broad training in the subject as a whole, and a training which deals with the foundation principles of the science with such illustrations of those principles as will appeal to the student in his present state of knowledge so as to connect the facts presented with the facts already his, and thus to give him that toward which all education aims, the mastery of self in his manifold relations to the world in which he lives.

This is the end I have had in view while outlining the chief phases of the physics teacher's preparation for his work, which I may now, perhaps, best summarize in the inverse order of their presentation.

1 The physics teacher should endeavor to attain to as accurate and broad a mastery, both theoretic and practical, of physics itself as lies within his range of power and opportunity. This presupposes a corresponding mastery of mathematics and implies some skill in practical mechanics.

2 He should gain as wide a knowledge as possible of the related sciences, specially chemistry, and seek to find the salient points of contact of the other sciences with physics.

3 He should be a man among men, touching men at many points, helping and uplifting, always a man whose life embodies that strict conformity to the laws of being which his chosen science so perfectly exemplifies.

Prof. George M. Turner—Prof. Thwing's remarks about the tact needed in experimenting in physics are very true. It is sometimes a difficult problem for a teacher to gracefully get out of an experimental trouble. It requires a quick eye and a cool head to take advantage of a failure to have things go as they ought to go, and turn all toward success.

I recall two instances of experimentation apropos of this point. Some time ago I visited an evening's entertainment in which the instructor of the college had divided the work of presentation of the subject among the young men. Each had his prescribed part and was expected to make his explanation and experimentation fit with that of the young man preceding. The explanations were well learned and related how the experiment would work and what consequences would follow certain conditions. Unfortunately in many cases the experiments would not work and the consequences did not follow the young men's conditions. Very naturally the young men became decidedly embarrassed and matters became very much confused. Probably the audience suffered as much as did the chagrined young men.

Another time at a lecture the unexpected happened, but the tact of the experimenter turned failure into success. The Chinese ambassador had come over from Washington to visit the Johns Hopkins University. At this time Prof. Remsen was lecturing to his classes on hydrogen. By one of those unfortunate coincidences, the oxygen and hydrogen had mixed in the wrong place and a terrific explosion followed, wrecking much of the apparatus on the table.

The Chinese ambassador, thinking this part of the program, loudly applauded, while Prof. Remsen coolly bowed his acknowledgments of the appreciation, said "Thank you," and went on with his lecture as though nothing unusual had happened.

Prof. W. M. Booth—I would like to ask Prof. Thwing what he considers the minimum training in mathematics and physics for a properly prepared physics teacher.

Prof. Charles B. Thwing—He should get all the training he can get. I would not specialize in mathematics and physics to the neglect of the other sciences. Elementary mathematics he ought to take, then trigonometry. I do not know that he needs calculus with his other training. It ought to be possible to experiment in the language the student understands already.

The idea I had was, that every teacher should have had a full course in mathematics to do satisfactory work in a high school. Possibly some succeed without it, but some do not.

Inspector Charles N. Cobb—I was reminded during the delivery of this paper of a little incident which happened last summer. One sunny, sultry, Sunday afternoon, there came up to my front porch in Albany a gentleman of my acquaintance who came on some church business. He brought with him his son, a young man who had completed a year's postgraduate work in chemistry. After the excuse for the call had been cared for, he spoke of the fact that his son thought of teaching chemistry, and that he thought, also, of becoming a professional chemist. His father was so situated that he could go on with his work for several years without providing any income, and the young man said he thought he would like to teach chemistry, but he thought possibly it might become monotonous. He thought he might have to teach the same thing year after year and it would be monotonous. I suggested to him that he might be teaching the same thing year after year, but that he would not be teaching it to the same persons; that, however, if his object in teaching chemistry was not to inculcate into his subjects as much as possible, but was simply to teach it, the probabilities were that it would become monotonous. On the contrary, if his object was to make men and women and to do it by teaching chemistry, it would not be monotonous at all.

I was glad that the reader of this paper referred to this same idea. I believe most heartily, that we should constantly remember that the object in view in teaching is to make students who shall have the ability to think and to do.

This morning, I think it was, that reference was made to that little book of Prof. James (*Talks to Teachers*), in which he remarked that, " the best educated man is he that can do the most useful things with the least effort." I think we will all agree that the *subject* of physics will go as far to assist students to do useful things as any subject that is found in the curriculum. And I believe the *teaching* of physics will go farther. When I say to do things, I mean to do them not only with the hands, but the brain as well.

Again, if you will allow me to refer to my observations. As I go about the state I find not a few who are striving to teach physics who are not able to do things with their hands, teachers of physics who can not manipulate apparatus.

Some of you were present at the address of Prof. Nichols at the Ithaca meeting, and you remember that one of the things that he did that evening was to produce different types of vibrations of a cord. He remarked that the experiment was a success, but he also remarked afterward that he did not do as well the first time he tried it. The habit of manipulating on the part of the teacher is an important matter.

I believe that the teachers of physics are as well prepared as the teachers of many other subjects, but we have every reason to desire marked improvements.

Prof. Howard Lyon—There is one feature of the paper read today that was specially interesting to me—that in which the speaker called attention to the difficulty in learning physics, due to the abruptness of the subject-matter. It is to me one of the most important considerations to the teacher of physics and deserves a more extended reference than was given to it in the paper.

I wonder why the secondary schools do not adopt what is excellent in the methods of the colleges. These methods are not ideal but certainly in one respect they are right. The college plan does take into consideration the time element in its instruction.

An individual can not take his three meals in the morning but he must have an opportunity to repeat his meals as he can digest and assimilate them. Facts and principles in physics require time for mental digestion and assimilation.

I do not advocate a sweeping reform in our methods, but I do know that lessons in physics and science in general can not be crowded to advantage. We try to teach physics in 20 or 40 weeks, and its new matter comes too abruptly to permit even superficial understanding in most cases. This fact is specially true in the case of girls whose early experience with reference to physical facts and phenomena is limited.

Expert opinion seems to differ as to the nature of the masculine and feminine mind, but I am sure that the difficulties that girls meet in physics arise not from the difference in their nature mainly, but from the poverty of their fund of observational knowledge.

Girls are not permitted to see mechanical devices in their childhood, and mothers seem reluctant to encourage observation and interpretation of physical phenomena. If girls could have a better opportunity to observe in their early life they would be better prepared for their high school work. If their training is not begun in their homes it should be begun in the schoolroom.

Every girl that I have ever taught has been a splendid student of physics if she has been what is termed a "tomboy" and she has always taken up her advanced work with enthusiasm. I am now teaching a girl who runs, jumps and throws a stone as well as a boy and she is an excellent student of physics.

Much is said of nature study. This instruction has, in a large manner, omitted experiments that have to do with physical forces. The phenomena of the air, of lightning, wind and storm are not less attractive than the phenomena of life. Why can we not begin in the grammar school with lessons concerning physical forces, something that would lead a boy or girl to understand mechanical devices? Why not let them have occasional lessons and simple explanations of principles that are now restricted to high school pupils? Why can not the teacher present these lessons very simply, not as formal science but as simple practical instruction? I have seen marked results in later development in the case of students who had had simple lessons in their early training in physical phenomena.

Prof. Charles F. Binns—I am very much interested in this discussion of the study of physics and particularly the turn which the discussion has taken. I think that it is very evident that the girls might take a different attitude toward the subject of physics. I believe that the feminine mind will continue to measure her dress by her fingers. It is something like the Irishman who said, " It is twice the breadth of the length of my hand, and the width is as thick as a brick."

As a means of measuring the capacity of the teacher, it is out of the question to ask, how far it is necessary to go to qualify in a certain subject. The more reserve force a man possesses may be the measure of his success as a teacher, but knowledge is not the only necessity for the aptitude to teach successfully.

It seems to me, that in this subject of physics the general aptitude for mechanics should come well to the front. The most successful teacher is the one that can handle tools.

Prof. H. J. Schmitz—I am somewhat troubled in my teaching of physics to know the amount of theory to use in connection with it. I think the less theory we take the better it is. I should like to know what other teachers do.

Prof. C. B. Thwing—We are teaching half a dozen sciences in one and the student must be helped to remember a great many facts. A theory, even though not proved to be true, may be a great help to the student in classifying the facts and remembering them.

To illustrate, I sometimes tell a little " fairy story " to explain latent heat. Where does the energy go to that is used to melt a body? If we think of the molecules as having different dimensions along different axes it is possible that when a definite temperature is reached the molecules begin to rotate about their longer axes. This would consume energy and increase the freedom of motion of the molecules without raising the temperature. The side bonds would be neutralized, while the end bonds hold the molecules together in the liquid form. When all the molecules have been put in rotation the temperature would again rise, till at the boiling point the molecules begin to rotate about their shorter axes and cohesion is entirely destroyed, and the gaseous state is reached.

The student is helped by such concrete pictures to master the abstract laws of the science.

PREPARATION AND TRAINING OF THE TEACHER OF CHEMISTRY

BY DR LYMAN C. NEWELL, STATE NORMAL SCHOOL, LOWELL (MASS.)

A recent number of a popular educational journal contained the following significant statement, "One becomes weary of listening to the numerous descriptions of what the teacher ought to be, when teachers are and will continue to be just ordinary mortals." At a first glance this assertion seems true, but a more careful consideration leads us to conclude that it is a specious half truth. The programs of educational gatherings during the last five years in this country and in England have had one marked characteristic, viz, an unusually large number of papers and addresses on the art of teaching. This is specially true of those meetings devoted to science. At the meeting of the American Association for the Advancement of Science held at Denver in August 1901, seven papers on the teaching of chemistry were read before the Chemical section, one of them being the annual address of the vice-president and chairman of that section. These papers covered all branches of pedagogic chemistry, and their presentation confirms the view that, however weary some may be of hearing what a teacher and teaching should be, all are not disposed to ignore the public presentation of this means of improvement.

Believing this, I willingly accepted the invitation to present to you some thoughts on the preparation and training of the teacher of chemistry. Progress in teaching comes largely from consultation, comparison and publication. Bad methods can never be eliminated by concealment, nor can good ones be spread by hiding them under a beaker or in a water bath. Methods need constant regeneration. Education, specially in science, is evolutionary. There are few long steps, few sudden leaps in our work. We must keep moving; the fountain must be constantly playing. Cessation is stagnation. I hope the time will never come when we can not talk, write, consult and argue about our work.

Teachers of chemistry need a broader, more uniform and more accurate knowledge of the fundamental facts and principles of chemistry. The foundation is essential to the stability of any superstructure. If our knowledge of the fundamentals is uneven, or out of plumb, then our superstructure will be rickety and in danger of cracking or of falling over at some critical moment. Several reasons lead me to emphasize this factor in considering the preparation and training of the teacher of chemistry.

At the last meeting of the Johns Hopkins University Alumni Association of New England a classmate, who is connected with a large college, said, "The weakest part of our course in chemistry is the general inorganic for beginners." This is true, no doubt, of many other colleges. Several unfavorable conditions attend the instruction of beginners in chemistry in college. The laboratory sections are often too large to permit individual instruction, the text is usually presented to indifferent listeners in the form of entertaining lectures or of an intricate outline, and the course itself is often condensed to ridiculous brevity in order to conform to the unavoidable restrictions of the curriculum. It is true that these conditions are sometimes unavoidable and that the department of chemistry is only partly responsible for them. Nevertheless, the students suffer, and too many graduate from college inadequately prepared to teach elementary chemistry, because their instruction in that portion of the subject has been irregular. It is as true of chemistry as of most subjects, that we know best what we studied last. And many a recent graduate attempts to force his latest work on uffering and helpless beginners. Pres. Remsen once said, that when he left the University of Tübingen he could teach the nost advanced organic chemistry better than the elementary norganic chemistry. In many colleges the student passes lirectly from general chemistry to qualitative analysis, then to uantitative analysis, and finally to organic chemistry or some ther advanced work. Seldom does he have a chance to review is general chemistry from a broad standpoint. There is a endency in some institutions to remedy these defects, and efore many years students while in college will be able to lay hose broad foundations which are so essential for effective eaching of elementary chemistry.

A second reason for emphasizing the necessity of a better nowledge of the fundamentals is that in the last five years such n enormous number of facts have been literally hurled at us hat those houses which are built on the sand are in danger of eing swept away. Physical chemistry, electro-chemistry, hemical inactivity at low temperatures, dissociation at high emperatures, matter inert at all temperatures, radiant energy, nolecules of eight atoms, molecules of a single atom, and liqueied gases galore have been suddently thrust on us. I am not foe to these newer conceptions, nor am I indifferent to the nagnificent results obtained by such men as Ramsay, Nernst, J. Thomson, Van't Hoff and others. But important as these opics are and will become, they should not be allowed to usurp r obscure our conception of the foundations of chemistry. A eacher in one of our Boston high schools was asked by the vriter what use he made of the theory of electrolytic dissociaion. He replied, "I did considerable last year, but this year I hall do very little because my pupils did not see so much in t as their teacher did." Doubtless a similar vision of the ituation led one of the best known teachers of chemistry in his country to say in the preface of his latest book, "In the pinion of the author the time has not yet come for the abanonment of the study of the elements and their compounds in hat some are pleased to call the old-fashioned way. Indeed it seems essential that such study must always form the basis of the higher or spiritual study of chemistry." In a few years, no doubt, many of the simpler aspects of physical chemistry will form a part of our elementary courses in chemistry and must therefore be assimilated by teachers, but since physical chemistry is now only a part of the superstructure, it should not be mistaken for the whole edifice. Only the teacher who has a broad knowledge of fundamentals can appreciate the meaning of new details, for such a one alone can determine the value of component parts of the whole. Comfortable teaching is based on an accurate knowledge of the first principles, it rests on unshaken confidence in the primary truths. The teacher who lays the foundations wide and deep need never fear overthrow. On them he can build with assurance as high and attractive a superstructure as desired. A teacher runs no risk of being left behind in taking a year or more to strengthen the foundations. He can easily catch up with the facts, and as he moves onward these facts will find a logical and permanent location in his mind.

A convenient and efficient way to obtain a knowledge of the underlying facts and principles of chemistry is by a judicious and thoughtful study of one of the large manuals of chemistry, such as Remsen's, Mendelieff's, or Freer's, Newth's, Richter's, or Roscoe and Schorlemmer's. Working familiarity with any of these books is an enviable acquisition. They are reservoirs from which we may draw our supply at any time. Make a business of it. Take a year for the task, if necessary. Read with a notebook at hand, or better still mark the margin of the book itself. Determine to remember where and how the facts and principles are treated. Imbibe the spirit of the author, see the truth from his standpoint. Do not be satisfied till the task becomes a pleasure. Gradually the whole panorama will come into view, facts hitherto unknown will assume their proper relation to the whole subject, experiments which one may have thought were his own discoveries will be accredited to the rightful discoverer (possibly Boyle or Lavoisier), laws will reduce themselves to that beautiful simplicity which is an expression of an harmonious nature, theories instead of being mere guesses will inspire to deeper thought and perhaps to intelligent experiment, and out of the vast mass of facts, laws, hypotheses, and theories a foundation will unconsciously be laid on which can be built with confidence and skill a superstructure in which ideas new and old may be harmoniously, artistically, and truthfully incorporated.

The preparation and training of the teacher of chemistry should not be confined solely to this science. Interest should be stimulated in allied sciences. No single science is an independent unit; all overlap. Chemistry has some connection with all the physical and life sciences. Together with physics and pure mathematics it forms the great triangular foundation of physical science. Hence a general knowledge of other sciences is not only helpful but to a certain degree necessary to the successful teaching of chemistry. Such a knowledge keeps one from becoming warped and prejudiced in his judgment of the methods, value and significance of other subjects in the curriculum. Love and enthusiasm for chemistry should not mean contempt and hatred for physics or biology. In answer to the question, "Do you prefer to teach another science besides chemistry?" 19 out of 20 representative teachers in Massachusetts replied "Yes". Those who taught physics invariably regarded this additional work as helpful. The speaker has found physics and mineralogy exceedingly helpful in interpreting many phases of general inorganic chemistry. A science needs a margin, a sinking fund, a reservoir, just as a picture needs atmosphere or a poem needs inspiration. A knowledge of perspective alone will not make an artist, nor will a knowledge of prosody make a poet. And it is just as true that a knowledge of chemistry alone will not make a good teacher of that science. We need "the more" to apply "the little", something beyond the subject to teach subject-matter. Our point of view, our estimation of values, our humor, our judgment, our mental horizon, our general reading, and our hints for the pupil's reading, all these really depend on something outside of mere chemistry. Photography, astronomy, mineralogy, geology, and physical geography stimulate interest in certain aspects of chemistry. This margin, this finish, this better part is that indefinable something which places the inspiring teacher on the right hand and the dull pedagogue on the left.

Probably most teachers of chemistry have at one time or another studied other sciences. It is advisable to arouse this dormant interest and to acquire a generous sympathy, a working knowledge of these sciences. This may be done by reading the scientific journals, such as *Science*, *Scientific American*, *Popular Science Monthly*, *American Journal of Science*, *Journal of the Franklin Institute*, and by all means the latest journal, *School Science*. Avoid newspaper science. It is usually downright absurdity or barefaced error. A few hours judicious reading during a month will suffice to keep pace with all that one need know of other sciences. Form the habit of reading these journals and stick to it. A German professor was once asked about the progress of a former student. He shook his head and replied, "*Ach, er liest nicht mehr*" (alas he reads no more). Let us take care that we are not similarly condemned.

A few years ago the New England Association of Chemistry Teachers sent out a list of questions, mainly to New England teachers, covering all phases of teaching. Among the questions was this one, "What is your aim as a teacher of chemistry?" An answer which typifies the aim of the best teachers was, "To teach pupils a love for truth and for the science, and to develop a scientific spirit." A most desirable requisite which teachers themselves need is a scientific spirit, or, perhaps better, a scientific attitude of mind. The distinguishing feature of science teaching is not merely the provision of an opportunity to observe, conclude and record. Its vital object is to create and foster a scientific attitude of mind. The highest attainable result will follow, if a scientific spirit is aroused.

That attitude of mind called scientific is hard to describe. One of the most scientific teachers of chemistry in the United States said, "It is asking a great many questions, but few foolish ones." Some of its attributes are a determination to know all the evidence before pronouncing a judgment, precision in thought and statement, a desire to deal with the thing itself, not trusting to secondary sources, unshaken confidence in the triumph of truth, fearless abiding by tested results, willingness to change our conclusions when new evidence is presented, disbelief in the traditional superstitions and nonsense of our ancestors.

Sometimes contrast makes a subject clearer, and possibly the term scientific may be made clearer by illustrating an unscientific state of mind. To deny the truth of what displeases us is unscientific. We have had an excellent example of this species of unscientific behavior in the naval battle recently fought on dry land and in the newspapers. It is also unscientific not to admit our errors, specially our published errors. It is likewise unscientific to accept elastic theories. Prout's hypothesis, the evolution of the elements from a single element, and theories which violate the laws of thermodynamics belong to this class. It is furthermore unscientific to jump at conclusions which we would like very much to draw, if we only had sufficient evidence. How many new elements are annually announced! How many new discoveries are daily heralded which will set the earth spinning from the east to the west as soon as the pseudo-discoverer has obtained a little more evidence! We need more chemists like Morley and no more physicists like Tesla, we need more astronomers like the late lamented Kepler and no more like—well, I must not be captious. I am sure the point is clear.

Probably no general rule can be prescribed for the attainment of a scientific attitude of mind. Yet it can be cultivated. One of the best ways to acquire and foster it is to do some original work. It matters not how extensive or how slight the work, provided it possess the element of originality. Nature by some inscrutable law has decreed that we can learn only of and through ourselves, no one else can learn for us. The soul itself must come to a consciousness of the truth before knowledge is a possession. Every bit of original work coins knowledge. An original demonstration of the hitherto unknown properties of a chemical compound is worth more to the experimenter than a vast mass of memorized facts. The construction of a new piece of apparatus or the improvement of a method demands continuous exactness of thought infinitely more helpful in acquiring a scientific attitude of mind than can be gained by the remodeling of a whole scheme of qualitative analysis. One reason, I fear, why some teachers shrink from the performance of a few simple experiments demanding exact weighing or measuring is their inability—or would I not better say unwillingness—to carry out the train of reasoning involved in such work. A few hours a week—part of our wasted time—spent in the performance of some original work will soon give that attitude toward teaching science which a genuine judge has in the trial of cases. It will give a mental grasp which is comprehensive enough to perceive the exact value of evidence. It will bring one face to face with truth.

It is impossible, however, for all teachers of chemistry in secondary schools to do research work. Numerous duties consume all spare time, apparatus and materials are not readily obtainable, and books and chemical literature are not always available. On the other hand, it is possible for such teachers to do some work possessing the element of originality. The simplification of apparatus, the wider application of new methods, the qualitative examination of some mineral, rock, mineral water, or industrial by-product offer ample opportunity for original work. Again, if no such work can be done, the teacher should write. Exactness of statement is a mark of exactness of thought. And exactness of thought may be acquired by critical writing. Put your thoughts into accurate language. Tell us about some interesting natural phenomenon in your locality, an example of chemical erosion, a piece of apparatus which has helped you over a hard place, write a brief biography of some of the newer chemists, tell us about anything which interests you. What interests you will surely interest someone else. A managing editor of *The Sun* (New York) when asked by a correspondent what to write up, replied, " Anything that interests you—nothing else." Stevenson always carried two books in his pocket, " one to read in and one to write in." Publish what you write, read it before some association or to a friend. Help overcome the false notion that a scientist can not write clearly and entertainingly. Help make it impossible or at least untruthful for an editor to announce in a prospectus, " We assure you that these articles on science will be both good writing and good science, a combination that is unfortunately too often lacking."

Till about a decade ago chemistry was taught in high schools almost exclusively by a textbook. The pupil studied the book, recited what he had time to memorize, and occasionally listened to lectures or talks by teachers who often did some experiments. This unscientific method of teaching the science of chemistry began to be abandoned about 10 years ago. Some schools went to the other extreme in allowing the pupils to do all the experiments, while the teacher did the studying and reciting. Fortunately the evil effects of this second unscientific method of teaching the science of chemistry were soon discovered, and it is gradually being replaced by a judicious combination of individual experimental work done by the pupil, study, explanation, and recitation of textbook by the pupil, and largely informal lecture instruction by the teacher. It would be profitable to discuss the bearing of these three elements on the preparation and training of the teacher of chemistry, but the time at my disposal compels the limitation of the discussion to one phase of one element, viz, the supervision of laboratory work.

It seldom happens that a method of teaching changes suddenly, but when the change is abrupt, the application of the new method is attended with more or less misfortune. The laboratory method of teaching chemistry came on us rather suddenly, and in many schools its use has not only been injudicious but unprofitable. We know very little about its psychology and still less about its ethics. Many teachers can not account for their failures, and hence they are not slow to condemn the laboratory method, whereas it is the fault of the teacher, not of the method. Though my views on this question have appeared in print, I can not refrain from repeating some of them, because I believe the failure to grasp certain psychologic principles accounts for much of the aimless work done by pupils and for some of the unrest, discomfort, and inefficiency shown by many teachers in all sections of the country.

Laboratory work is concrete labor. It employs the hands as well as the head. Concrete labor is difficult to shirk. In studying history, geometry, or language the mind easily wanders. But when the mind is following an experiment in the laboratory, it does not readily ramble. Something is constantly happening; the mind being carried quickly from concrete to concrete has little or no time to roam. Apparatus must be arranged, chemicals collected, the experiments started, watched, controlled, or stopped. If, however, the teacher or the principal does not favor laboratory work, if the program restricts the experimental work to a pitiable minimum, if the teacher persists in explaining in the classroom what the pupil can think out unaided in the laboratory from his own data, then it is folly to expect the laboratory work to yield mental results. There must be enough carefully prepared and judiciously supervised laboratory work to prevent the normal tendency to shirk and to teach the pupil the supreme value of mental self-reliance. Again the experimental work must be dignified enough to command the self-respect of a thoughtful pupil but not so difficult or repulsive as to frighten him, for in either case the tendency to shirk will be hard to overcome. Furthermore, the laboratory work must be followed up by searching questions, for if the pupil once gets the idea that he need not think after he has completed his experiment, then you have opened for him a broad avenue for shirking. Each pupil should be taught at the earliest possible moment that he or she may be asked any reasonable question on any experiment. If such a spirit prevails, pupils soon learn to get from this concrete labor that invaluable acquisition, so often needed in later life, viz, the power to complete a piece of work accurately, quietly, quickly.

Again laboratory work is suited to relieve mental fatigue. It is restful work, if rightfully performed, because it affords opportunities for harmonious activity. But, if the laboratory period is too long or too short, if confusion reigns, if there is no opportunity for pupils, specially girls, to sit down in the laboratory while writing notes, consulting reference books, or performing slow experiments, if the directions for performing the experiments are brief, long, or so vague that their interpretation demands an excessive amount of mental energy, then mental fatigue will be increased, not relieved. The laboratory work under such circumstances can not afford that mental rest which it is designed to provide. Mind and body will refuse to act normally.

Third, laboratory work is a grand medium for the production of the highest grade of reactive conduct. Reception is followed by reaction, impression by expression. Motor activities are the expression of thought. But, if the laboratory work is inadequately supervised, owing to large divisions, program irregularities, or pedagogic inefficiency, then the reactive conduct will be of a low, perhaps the lowest, grade. The pupil who is called on to be doing something constantly should be stimulated by an environment which will enable him to do the right thing in the best way. Good expression can not come from bad or meager impression. Teachers of chemistry who let the laboratory run itself, who do not help a confused pupil to regain mental poise, who do not realize that beginners need constant advice and direction, are unprofitable servants of the science of chemistry. The teacher's place is beside the pupil, showing him how to form good habits of observation, teaching him the difference between accuracy and vagueness, preventing him from doing slipshod or slovenly work, stimulating him to cultivate mental self-reliance, not telling him facts which he can observe himself, but suggesting legitimate channels for the application of his total power. I recall with pleasure my work under Pres. Remsen, because he never discouraged me when I needed help and he always left me to myself when he saw that the best avenue of escape was through my own mental efforts.

Again, we must not be satisfied because our pupils are curious. Curiosity is a good sign, but at best it is only a means to an end. It should be encouraged at first, but, once active, it should be rationalized. Pupils must be led from curiosity to interest, from mere indiscriminate desire to know disconnected facts to an intelligent craving for systematic knowledge. The transition from curiosity to interest is a critical time for both teacher and pupil. Too often a thoughtless word, an unintentional oversight, or a palpable lack of interest on the teacher's part may upset the delicate poise of the pupil's mind and turn to permanent indifference or reckless curiosity what might have become lifelong interest. Special care should be taken by the teacher to gather up the disconnected observations made by pupils and place them before the learner in such a light that the threads of curiosity will become the fabric of interest. Once interested, the pupil should be led on into the realm of voluntary attention. It is this factor that we all need to develop, for it is of incalculable value in the acquisition of knowledge; it is essential to complete psychic life.

Pupils seldom see the importance of voluntary attention. They are contented to "do experiments" and stop there. They need to be taught the fundamental value of learning to complete with success an experiment requiring patience, skill and confidence. The necessity of teaching voluntary attention is one reason why I believe so firmly that simple quantitative experiments should form a definite part of an elementary course in chemistry. Such work cultivates voluntary attention. As I have watched my classes for several years perform simple experiments involving accurate weighing or measuring, I have been forced to conclude that this work is the most effective way of teaching voluntary attention. It requires an effort of the will for spirited pupils to sit quietly before a balance till the pans stop swinging, to wait for a solution to run down the inside of a burette before the volume is read, to let a thermometer remain in a liquid long enough to assume the temperature of the liquid. But this very effort of the will is needed day after day when the pupil leaves school. It must be acquired, if one is to be a successful worker in any field.

Whatever or wherever our occupation, whether in Syracuse or Manila, we shall always need the power to think continuously, work skilfully, and judge accurately. We do not need chemists half so much as we need men who will voluntarily attend to their work. The problems which are coming on us as a nation need for their solution men who have been trained to do things accurately, with dispatch, with a regard for all the evidence, with a profound love of truth, for that truth which is so forcefully exhibited by the laws of chemistry, for that outer truth which arouses in one a consciousness of inward truth.

Closely related to curiosity, interest, and attention is the principle of inhibition. It was thought about half a century ago that certain nerves checked the action of certain muscles. This is doubtless true, but it is a narrow interpretation of a more general function of the nervous system. This conception of arrest has been extended to cover our mental life, irrespective of nerve stimulus as such, and is called inhibition. It is not necessary that an inhibiting idea be specially strong to arrest another idea, for here as elsewhere the mental machinery is delicately adjusted. A strong motor idea may be easily and completely inhibited by a simple and apparently foreign idea. Faint impressions on the confines of consciousness may throw a strong idea completely off the track. Some trivial observation may upset a thought which is seeking expression, and either arrest it completely or so modify it that the final judgment is delayed or even completely abandoned. Pupils should not be allowed to yield to unwarranted inhibitions. Provision should be made in all laboratory work for allowing the pupil's mind to travel without needless inhibitions from the object of the experiment through the manipulation to the conclusion. The work should be so supervised that pupils will see the whole field of consciousness and not yield to reckless impulse or foolish inhibition. Many books now in use actually prevent the mind from acting calmly, continuously, and logically. Experiments to be mentally profitable should be so expressed and arranged that the average pupil can not fail to grasp the title, the exact method of procedure, the essential observations to be made, and the probable conclusion which the observations will permit. The title of each experiment should be known so that the pupil may have an initial idea, a mental start, a guiding star. Unless he begins correctly, he may not, probably will not, end correctly. A knowledge of the exact method of procedure is essential, otherwise he will not know how, when or where to begin his work, nor can he carry it on intelligently, confidently, profitably. A great deal of time is wasted in a laboratory because pupils do not know how to work, and in many cases they are not to blame for this aimless, fruitless labor, because they were not at some time told or shown how to work. They yield to some foolish inhibition or reckless impulse, simply because they see no other path. Again, the desired observations should be indicated in some way. Pupils are learning how to observe; one object of experimental work is to teach observation. Surely we ought not to assume what we are trying to teach. Beginners do not know the difference between the trivial and the important, the scientific and the unscientific. They must be pointed toward the path having the fewest inhibitions, even though such direction reveals some truth which they might possibly discover if sufficient time were taken. Finally, each experiment should lead to some definite result. Otherwise the student is left suspended, is actually robbed of the inestimable privilege of drawing a conclusion. Experience shows, however, that this conclusion must be indicated. It need not be deliberately told, but it can be suggested by appropriate questions. Such questions eliminate inhibitions, they conduct the mind along a logical path, they extend a helping hand to a halting thought, they train the mind to pass from cause to effect.

If you ask how the teacher may attain the power to apply these principles, the answer is simple. Study your pupils and yourself, but yourself the more. The problem has only two unknown quantities—yourself and your pupil. Success depends on the teacher's knowledge of his own psychologic and spiritual life as well as on the discovery of mental crises in his pupils. He must create an atmosphere which fosters calm, deliberate, confident, tranquil mental action. He himself must have passed through the gates of curiosity and interest into the temple of voluntary attention before he can lead others to the same spot. He must acquire that spiritual insight which perceives the truth in himself, he must be constantly conscious of that better self, for it is this unseen self which teaches.

Section B. BIOLOGY

PREPARATION OF SECONDARY TEACHERS IN BIOLOGY

BY PROF. FRANCIS E. LLOYD, TEACHERS COLLEGE, NEW YORK

We may well, at the outset, present our conception of the high school as a factor in the preparation of men and women for their life. The most important feature of the high school lies in the fact that it is the final and only school of higher education for the multitude of men and women in the higher walks of life. Only a very small proportion have had or will have in the future more than a high school training. To give the very best opportunities for that education in the most efficient way is a task worthy of the best efforts of highly educated, trained and earnest teachers, which our unexampled opportunities for higher education can supply. This much must be conceded and kept ever in the foreground of the teacher's consciousness that to do the daily round of duties as a leader of a generation of youth just on the threshold of manhood and womanhood is a high privilege not to be measured by dollars and cents, nor even by the approval, often too tardy, of the audience of parents and supervisors, but by the conviction that his work will surely count for the amelioration of the individual morally, mentally and physically. A teacher with such a conviction, and thoroughly equipped for his work is filling a high office in society. It is not too much to expect and demand that persons who look to filling such an office shall be able to satisfy all the demands for efficiency which may in justice be made on them.

What, then, are the demands as actually formulated? On this point there is at this time no general unity, but for our present purpose we may examine the regulations formulated by New York city. These represent the maximum demand, and will serve for the time being as a goal for which the rest of the country would do well to strive.

Scholastic attainments and teaching experience are set off against each other. When the former are present, in the highest amount, they consist in bachelor's degree and two years' postgraduate study, accompanied by some knowledge of the science of education. In the absence of these, eight years' successful experience may be substituted for them. Though these demands represent the extreme in this country, it will be noticed that a candidate may enter the work with no teaching experience and after no special study of the problems which he has to face, and the special methods of the subject involved. Otherwise, the demands are fair, and have been effective in building up a body of efficient teachers.

Let us now turn our attention to the actual conditions which obtain in the large majority of our high schools throughout the country. The teachers may, roughly speaking, be considered, as to their origin, as consisting of two groups; those, namely, who have had no regular opportunities beyond the normal school and whose preparation has been received primarily there; and, secondly, those who are college graduates merely, or hold one or more of the higher degrees. It must not be understood that we are, in considering these facts, launching any criticisms against the many able teachers who, with acknowledged incompleteness of training, are themselves doing all in their power to advance the educational work of the high schools. It is, however, necessary to collate the facts in order to aid in bringing about the much needed development toward a uniformly high standard of work. The greatest step toward this is gained when we demand and get uniformity in the preparation of the teachers themselves. And by uniformity we mean, not a rigid formal kind of uniformity, but a uniformly high grade of teachers, whose work shall always be above a standard of quality we can hardly at present be said to have reached.

The teaching force of our high school, then, is made up, in the first place, of persons who have at best made use of the opportunities afforded by the average normal schools. Of such, some have gone directly into high schools after, perhaps, supplementing their attainments by taking courses in summer schools, at seaside laboratories and the like. These persons have had, it is admitted, certain advantages over the college-trained, to be considered later, in that some attention has been paid to the general and particular educational requirements demanded of the candidate for school positions. We must observe, however, that such training as they get is very insufficient in amount and admittedly adapted, not to the needs of the secondary, but to those of the elementary teacher. And here we contend that preparation for elementary teaching is not preparation for secondary teaching any more than experience in the university prepares for efficient work in secondary instruction. It may be and has often been maintained that it involves merely a question of adaptability on the part of the teacher. Without denying the contention, we still hold without fear of denial that the facts observed indicate pretty strongly that such adaptability is lacking, and the practical result is that we find at the present moment all kinds of courses, from essentially college work to essentially grade work, offered to the high school student. And this is not right.

It very frequently happens also that teachers in the elementary school, allured by the large money return to be obtained in high school positions, amplify their normal school training by taking work in the summer and seek high school places. This indicates an ambition on the part of such teachers which is at once to be commended and deplored, and a condition in our school system only to be deplored. We condemn without qualification the failure to recognize, in an economic way, the worth of the kindergarten and the elementary teacher. Their office is no higher and no lower, their responsibility no greater and no less than that of other teachers; and, utopian or not, we look for a time when the pecuniary reason for a progress, if we may so call it, from the elementary to the high school will be removed.

There is, however, another reason for the change sought by many teachers, a reason which must be recognized as valid and working out for good on the whole. Without qualifying our contention as to the equal value of elementary and higher education, we are forced to admit differences in temperament and mental life which make elementary teaching as much of a drag to some as a delight to others. These are differences which qualify or disqualify, and a man or woman whose intellectual life is not, to a fair measure, satisfied and stimulated by the more heterogeneous elementary course, may well endeavor to find satisfaction in the less heterogeneous character of the high school course. Recruits to the force of secondary teachers of this kind should be welcomed, but only on the satisfaction of rigid demands to be outlined further along. Barring such demands represent the extreme in this country, it will be noticed that a candidate may enter the work with no teaching experience and after no special study of the problems which he has to face, and the special methods of the subject involved. Otherwise, the demands are fair, and have been effective in building up a body of efficient teachers.

Let us now turn our attention to the actual conditions which obtain in the large majority of our high schools throughout the country. The teachers may, roughly speaking, be considered, as to their origin, as consisting of two groups; those, namely, who have had no regular opportunities beyond the normal school and whose preparation has been received primarily there; and, secondly, those who are college graduates merely, or hold one or more of the higher degrees. It must not be understood that we are, in considering these facts, launching any criticisms against the many able teachers who, with acknowledged incompleteness of training, are themselves doing all in their power to advance the educational work of the high schools. It is, however, necessary to collate the facts in order to aid in bringing about the much needed development toward a uniformly high standard of work. The greatest step toward this is gained when we demand and get uniformity in the preparation of the teachers themselves. And by uniformity we mean, not a rigid formal kind of uniformity, but a uniformly high grade of teachers, whose work shall always be above a standard of quality we can hardly at present be said to have reached.

The teaching force of our high school, then, is made up, in the first place, of persons who have at best made use of the opportunities afforded by the average normal schools. Of such, some have gone directly into high schools after, perhaps, supplementing their attainments by taking courses in summer schools, at seaside laboratories and the like. These persons have had, it is admitted, certain advantages over the college-trained, to be considered later, in that some attention has been paid to the general and particular educational requirements demanded of the candidate for school positions. We must observe, however, that such training as they get is very insufficient in amount and admittedly adapted, not to the needs of the secondary, but to those of the elementary teacher. And here we contend that preparation for elementary teaching is not preparation for secondary teaching any more than experience in the university prepares for efficient work in secondary instruction. It may be and has often been maintained that it involves merely a question of adaptability on the part of the teacher. Without denying the contention, we still hold without fear of denial that the facts observed indicate pretty strongly that such adaptability is lacking, and the practical result is that we find at the present moment all kinds of courses, from essentially college work to essentially grade work, offered to the high school student. And this is not right.

It very frequently happens also that teachers in the elementary school, allured by the large money return to be obtained in high school positions, amplify their normal school training by taking work in the summer and seek high school places. This indicates an ambition on the part of such teachers which is at once to be commended and deplored, and a condition in our school system only to be deplored. We condemn without qualification the failure to recognize, in an economic way, the worth of the kindergarten and the elementary teacher. Their office is no higher and no lower, their responsibility no greater and no less than that of other teachers; and, utopian or not, we look for a time when the pecuniary reason for a progress, if we may so call it, from the elementary to the high school will be removed.

There is, however, another reason for the change sought by many teachers, a reason which must be recognized as valid and working out for good on the whole. Without qualifying our contention as to the equal value of elementary and higher education, we are forced to admit differences in temperament and mental life which make elementary teaching as much of a drag to some as a delight to others. These are differences which qualify or disqualify, and a man or woman whose intellectual life is not, to a fair measure, satisfied and stimulated by the more heterogeneous elementary course, may well endeavor to find satisfaction in the less heterogeneous character of the high school course. Recruits to the force of secondary teachers of this kind should be welcomed, but only on the satisfaction of rigid demands to be outlined further along. Barring such exceptions as just indicated, we can not admit that the average elementary teacher who has gained admittance to the high school in the way here under discussion, is in any degree fitted for the work. Years in the lower school have fixed ideals and conceptions of teaching which, as expressed in method, are not adequate for the high school, and on the whole tend to lower the standard and nature of secondary education. Add to this the usually wofully deficient and hazy knowledge of the special subjects on which they are required to concentrate, and we have the cause for a lamentable degree of failure in development of the high school. If any proof is needed of the truth of the last statement, one has but to be subjected to the necessity of examining a few normal school graduates on the most important general knowledge of physiology, by which we mean physiology of animals and plants—knowledge which is fundamental for each and every teacher, without which any presentation of botany or zoology must necessarily be completely inadequate and misleading—to be convinced. I do not attempt to throw blame on anyone, teacher or student, in particular. The normal school has avowedly its definite object in preparing teachers for elementary work. It certainly can not, under its present construction, expect to do more. It is maintained that the means to one end may not properly be regarded as the means to another.

Before closing this part of the subject, it would be only fair, if time permitted, to consider at greater length the case of teachers who, after extending their education by studying at summer schools, gain entrance to high school teaching. To make sweeping generalizations is here specially dangerous, and the best one can do is to argue from the few definite cases which come under one's notice, and from the nature of the preparation in general.

In the second place, we see the high school staff recruited from the ranks of those who have received their bachelor's degree. This implies at most some general work in education proper, without any practical work, and at best an insufficient knowledge of the subjects which the candidate is required to teach.

It will be seen that the normal school graduate is thus in a position of advantage in point of professional training, and on this rests the belief, only partially justified, that the deficiency in scholarship is made good. We may here not improperly acknowledge the debt the community owes to the normal school for carrying on a work which has made for a body of teachers of constantly increasing efficiency; we still maintain, however, that the aim of the normal school is at a different—not a lower or a higher—mark than that of the high school, and therefore is inadequate to our present needs in this regard.

That the college graduate is not sufficiently prepared for the work before him as a high school teacher may not be doubted. His attainment is represented, in biology, by, say, two years of zoology—occasionally more, often less: and what shall we say of botany? In a great many cases, the credit of a 14 week course in " analysis " or " picking flowers to pieces " is a flattering maximum. Very frequently, in many of our leading colleges, a sort of appendage to the course in elementary biology, by a zoologist, is made to do duty for the whole subject of botany. It would be laughable if it were not almost pathetic. Is it any wonder that elementary teachers in botany are still floundering around in a mire of antiquated morphology? Is it any wonder that botany, which in most people's minds is still " picking flowers to pieces," is regarded as a study for girls? An examination of a class of girls offering a college entrance option in botany had disabused the speaker's mind of even this. And it was Huxley, that veteran in the fight for progress in education, that urged so often the placing of botany and human physiology in the schools. Does any one suppose that, in his mind, botany was the namby-pamby kind of thing it has grown in this country so frequently to be?

The knowledge of physiology, too, which the college graduate, as such, possesses is very often far from sufficient to give him anything like what is called a grasp of the subject, and may more rightly be characterized as a conglomeration of confused ideas.

Here, again, I must not be interpreted as criticizing directly our colleges or their graduates, though neither may be said to be beyond criticism. Each institution has to be governed according to its own resources and can not, if it would, always satisfy external demands. Too often, however, they will not.

As to the students, they are ill prepared partly because of the failure, for one reason or another, to use all the opportunities at their command, or because of their immaturity. The latter, I believe to be the real difficulty. The college course in the matter of time alone does not mean enough in the effect it has in refining the judgment; and the acquaintance with the subjects has not been long and intimate enough to result in that accumulation of knowledge from direct observation which alone makes a resourceful and inspiring teacher, independent of the textbook and full of his own invention.

As to the particular knowledge of the practical problems in facing a class, in planning and carrying out a laboratory course adapted to high school students, we may say that they know nothing. The result has almost invariably been that teachers who have had no training in these lines have taken their college courses and given them in rarefied, if not clarified, form to their students, and there has been a misfit all along the line.

In those communities in which higher demands have been made, where, accordingly, teachers holding the master's and even the doctor's degree have been obtained, some of these insufficiencies have been less apparent, sometimes more so. For greater special knowledge of the subject, with the total absence of professional training, has not always been an improvement on the other condition. Eminently successful teachers who have never had a special professional training, there are, but in spite and not by virtue of their lack. To say that teachers are born and not made does not exclude the proposition that, granting the qualities of birth, they may be vastly improved by definite training.

Having surveyed the present conditions of education, we may now move forward to our conclusion by outlining the ground which, we believe, the training of the secondary teacher ought to cover.

The requirements may be regarded, for convenience, as those in subject-matter and in education.

[1] The requirements in subject-matter should consist in at least nine points of undergraduate study in biology, of which at least

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[1] The following is a digest of the speaker's remarks under this head.

three should be either botany or zoology. The work in biology should be buttressed by thorough work in physics and chemistry.

During the senior year in college courses in education should be had, consisting in the history and principles of education, and in the theory and practice of secondary teaching in biology. The latter, with which we are specially concerned here, should consist in lectures treating of the various problems which confront the secondary teacher, of reading and discussion. This should, as far as possible, be made to yield practical results in giving the student exercise in the command of his powers of presentation. When possible, there should, also, be some time given to observation of public school work, carried on in an efficient and organized way.

The postgraduate preparation should consist of further study of biology at a recognized university for at least one year, during which period the student should receive training in methods of independent thought and investigation. This is not a demand that all secondary teachers should be actual research workers, but rather that the spirit and methods of the discoverer should be familiar to them through experience. At least the master's degree should be earned.

In education the work should consist in (1) a course in general secondary teaching, and (2) an advanced course in the theory and practice of secondary teaching in biology. The ground covered in such a course should be mainly practical, and should consist in a detailed study of the materials and methods involved, the construction of the course of study, and of actual teaching in the high school, under criticism.

The student's power to collate and organize the materials and to present the same in a scholarly manner should be evidenced by the preparation of a satisfactory thesis treating of some problem of secondary education. Such a course should lead up to the grant of a master's diploma coordinate with the master's degree, and of equal value with it, but with special significance.

The standard of scholarship set in the above statement is the master's degree, and, for the country at large, it is as high a standard as may at present be urged. It will be sufficient probably for some years to come, except in the largest cities, provided the scholastic attainments are accompanied by the equally important educational preparation.

Inspector Arthur G. Clement—I would like to ask Prof. Lloyd if the training he mentions presupposes a college education?

Prof. Lloyd—The first course is open to seniors, who have attained an average college record both in botany and zoology. We have allowed a student to take botany for the first time with the course. From now on, however, we have two courses, one of which will be open to seniors, and we can thereby allow them to take for the first one, either botany or zoology, whichever can be consistently taken with their course, but only in cases where it is absolutely necessary. In order to enter the more advanced course, they must have had at least two years' training in zoology and two years' training in botany, and at the same time must be pursuing original work in research.

Inspector Clement—A student should have a full course, and after that take up as much special work as he has time for. In addition to the training the teachers receive, they should have genuine love for the subject-matter and patience with the students. Teachers often fail because they have no patience. The student is not able to follow, and the teacher will not go over the work again. Hence I think that a good training should tend to make a teacher patient in helping dull students.

Prof. Henry R. Linville—The thought occurs to me that young people who are preparing for the profession of teaching, when not endowed with the necessary capacity for such work, should be made aware of their deficiency by training school teachers.

Prof. F. E. Lloyd—Of course a full college education is required, and preliminary knowledge of physics and chemistry is demanded. As to the points mentioned, love of subject-matter and patience with children, all those points have been taken up. As for me, I would not for a moment hesitate to criticize a candidate if I thought the motive was other than devotion to the profession, which should be the basal motive. As to the use of scientific literature, that is one of the things insisted on.

Prof. F. M. McMurry—I know a teacher who for years in the past has been obliged to work out his own experience. It has been somewhat to his advantage. By his experience he has been able to learn more and to study his pupils more. They are specially trying to train teachers, so that it will not be necessary for them to practise on the pupils that are placed in their charge.

WHAT THE TEACHER OF BOTANY IN SECONDARY SCHOOLS SHOULD BE PREPARED TO DO

BY DR A. J. GROUT, BROOKLYN BOYS HIGH SCHOOL

[*Abstract*]

I came here with several things in mind which I wished to say. A great many of them have been said much better than I could say them. Consequently I shall be obliged to slight some things that I intended to emphasize.

Of course a great many people who begin to teach, teach things because they must be taught. I have come more and more to a conclusion which is very trite and accepted by everybody, in my opinion, but is not lived up to, that is, that the aim of teaching is to make better, nobler, and more capable men and women, and not simply encyclopedias of learning.

I am outlining what I would like to do. We have our ideals, but can live up to them only as circumstances permit. We are not able to live up to them because of personal limitations also. I am able to a great extent to live up to my belief with respect to drawing. When a youth begins the drawing of scientific objects, help to bring out the finest points. If you keep at him, he will see every curve in the line, and he certainly is trained in the habit of observation. Fidelity to truth is not so common as one could wish, nor sufficiently appreciated. In science we should have exact truth. If our boys must tell the truth in matters of science, the effects are seen in moral character, and in time will spread to the other departments of life. Botanical knowledge offers general popular instruction. It should give to every one a new interest in life, an interest that can be taken up when other things fail. You see the lady in the city playing bridge whist, and the farmer's wife in the country lowering her moral nature, and injuring herself with gossip. A study of botany may correct these things and give new inspiration to those who otherwise have little hope in life.

I think a teacher who is training boys and girls and can not find and give the name of a flower is at fault. Finding the names of plants was formerly the basis of botanical work; and in cases where the study is properly taken up and properly adjusted, I know nothing more helpful in many ways. In my personal experience I have found it invaluable. I want pupils to ask themselves questions; if they find anything interesting in nature, to know what it is. What would our friends be to us if they were nameless? So in plant life. A person reads the description of a common and interesting plant; he can not connect it with the plant he knows unless he has a knowledge of names. I have never failed to awaken enthusiasm when I gave my pupils a proper knowledge of this part of the work. I give them the key if possible, and I want them to be able to find the names of a few flowers in the key. Prof. Ganong has said that this kind of work should be done as outside work by pupils who have special enthusiasm. I think there is a much more general need of this kind of botanical work than this. I would insist that all high school teachers should have the ability to name common objects.

The chief thing in the training of a teacher to do good work, is a love of the subject-matter and a love for the pupil. Enthusiasm is necessary to do anything well. What receipt do you give for enthusiasm? If you want to get it go where it is. It is communicated by contact. You want to go to those institutions where teachers are enthusiastic; and right here I want to add a protest against that great and influential university which discourages enthusiasm. If you want enthusiasm in botany, I can tell you places where it is, Columbia, Cornell, Michigan University, or the less well known University of Vermont. Then, the way to work up a sporadic case of enthusiasm is to do something original along the line of research. If you live within access of the forest, there are problems under your feet which have never been solved, and of which you can give the solution. We know very little about the life of our everyday plants. I did not know for a long time that one of our most common, the jack-in-the-pulpit, on attaining its full vigor, changes the sex and from male becomes female. Your discoveries are not only interesting to you, but you would find that there is no other field in which original observation can be carried on with so little previous training. Your laboratory is all out of doors. Now, if you want to work with enthusiasm and can not get where it is, take up the study for yourself with the best literature available. Tell the pupils of things you have done and read of.

Now you may have enthusiasm and work hard, and have enthusiastic pupils, and they may work hard, and yet they may not be able to pass examinations. I see examinations from a different point of view from many. At present our examinations test memory only. If our education is to do its proper work we must have examinations that test power rather than memory. It seems difficult to get up an examination that will test power. I can not say precisely how it should be done. Our business men claim that our teaching does not give power. As long as examinations test the memory only, and ability of pupils to pass in memory questions, so long shall we hear this complaint.

That our enthusiasm may not be dampened, I ask that examinations may be made up more with reference to this thought; then teachers will be enthusiastic, and persevere in enthusiasm.

If pupils have the power and desire to know more the teacher has done his work well, whatever the results of the examinations. The high school teacher should, doubtless, use the microscope, but it has the disadvantage that in most cases work with it can not be carried on outside of the schoolroom and must stop with the school course.

I believe in training the pupil so far as possible so that he will be able to follow the injunction of the poet to "go forth, under the open sky, and list to nature's teachings."

Prof. F. E. Lloyd—I am impressed by one point mentioned by Dr Grout, and that is, that high school teachers should be, to some degree at least, able to pursue original research in botany or zoology. It is coming to be one of the demands which may justly be made on high school teachers.

Section C. EARTH SCIENCE

GEOGRAPHY FOR TRAINING STUDENTS IN NORMAL SCHOOLS

BY PROF. A. W. FARNHAM, OSWEGO NORMAL SCHOOL

Before discussing the subject, geography for training students in normal schools, we must in a general way determine the place and purpose of the normal school. Its place is between the university and the masses. It is maintained by the people and for the people; and its purpose is to train teachers for more efficient service in the grandest of popular institutions, the public schools. Indeed, the graduates of normal schools holding certificates of scholarship from no higher institutions of learning than the normal schools, will, with few exceptions, find positions in the grades below the high school. The geographic teaching, then, of normal graduates, will cover the field included in elementary school geography.

Let us review the present status of geography requirements and opportunities in New York state normal schools. Their program of studies requires that students in training shall pursue geography the last half of the junior year and the first fourth of the senior year; in all, 30 weeks of daily instruction in 45 minute periods. The illustrative apparatus and material consist of ordinary globes, a not too bountiful supply of maps, one or more sets of raised maps, a modest collection of colored charts made from photographs, a few good lantern slides, and a comfortable working library. All this is good so far as it goes: it is excellent; but it does not go far enough. It does not meet the present demands of geography. How, then, would its efficiency be greatly enhanced? And in what should the "geography for training students in normal schools" consist? These two questions, from the writer's point of view, may be answered as one.

The more recent development and growth of the geographic idea, for want of a better term, has been called "the new geography." Dr Redway in his latest, if not his best published work, has supplied the better term: "the new *basis* of geography." He tells us, what we believe, "that a different interpretation of the nature and scope of geography is growing into the educational systems of the United States. Broadly stated, this interpretation is the mutual relation of geographic environment to political history on the one hand and to economic development on the other." This interpretation is demanded of geography today. A better means of its interpretation would increase the efficiency of geography teaching in our normal schools, and would also more fully equip our graduates for their work in grade schools.

One of the first needs, after an efficient teacher, is that of a laboratory furnished with models and apparatus for practical exercises in physical geography. The work to be done in physical geography can not well be done in the classroom. The models and apparatus to be used can not have proper care and manipulation in the classroom. The geography teacher realizes that a laboratory is a necessity. To illustrate: a study of local weather is in part a study of measurements of atmospheric temperatures, of atmospheric pressures, of humidity of the atmosphere, of direction and velocity of wind currents, all of which must be determined by apparatus working under certain conditions—conditions that can not be found in the classroom. A study of rocks—their composition, relative hardness, and comparative resistance to atmospheric agencies—is necessary for the study of the soil, and is legitimate laboratory work. Mathematical geography is necessary work for the laboratory. The greater part of field work, which is now a necessity in geography teaching, is profitably supplemented by laboratory exercises. The use of government maps, now regarded as indispensable in the study of geography, is unsatisfactory in the classroom. That laboratory work and field work coordinated impress on the minds of pupils the reality of the various earth forms and their influence on life, is not the least argument for the establishment of the laboratory to further the teaching of normal school geography.

The second need is that of an additional program hour to be spent in laboratory exercises and field study. This additional hour is given to chemistry and to physics. Without it, chemistry and physics would largely be deprived of their practical value. With an additional hour, geography would be as greatly benefited as chemistry is or any other experimental science.

The third need is either that of a reduction of the number of studies in normal schools, or an extension of time in which to pursue them. At present, individual student programs are made for from five to seven different subjects. It has to be explained that a student studying only four subjects has head trouble or heart trouble or some other serious defect. Life in the normal school is so "strenuous" that the one idea is to get out of the subjects, not to know them. Under such conditions teachers of geography, as well as those of other subjects, can not require of students as much time as the subject demands.

Here, then, is the most serious charge to be preferred against geography teaching in normal schools, namely, the lack of thoroughness caused by the student's attempt to do more work than can possibly be done in a given time. The result is superficialness and, what is worse, the belief entertained by the student that he knows a subject that still lies outside his mental horizon. Nor does his belief change to honest doubt till he attempts to teach geography. Then his energy is expended in getting subject-matter and holding in memory unassimilated material. His teaching, if it may be called teaching, begins and ends with the book. His pupils never learn from him that the hills and meadows, the streams and the valleys through which they flow, have related earth history, and that each earth form in their immediate neighborhood has had some influence on the settlement of the neighborhood, and also on the industries of its people; for every people will engage in those industries which will bring them the largest returns for their investment, and their geographic environment will largely determine for them what those industries shall be. For instance, the degree of slope is an important factor in determining whether farming or dairying will bring them the greatest commercial success; and also whether lines of transportation may be built with reasonable outlay to connect them with commercial centers, and later, perhaps, to make their locality a commercial center. The presence of water power and access to raw material may decide certain local manufactures. The pupils of a teacher whose geography is between the covers of a book do not learn that the study of the natural features of the landscape about them is a study of geography. How can they? The stream can not rise above its source.

Geography for training students is inadequate for the training students' mission, and will be till individual student programs are made so as to allow time for becoming more fully acquainted with subject-matter, through a wider acquaintance with geographic literature, thus giving the student such a broad grasp of principles that he will be able to teach geography and not the book.

It must be said that special method, or more properly, applied method, is disproportional to the knowledge of underlying subject-matter. Methods of teaching geography must be based on a knowledge of geography. The effort is often made to teach subject-matter and the method of teaching it at the same time, or "some of each" in the same lesson hour—a thing quite unpedagogic. It is not possible that one can give equal attention to a subject of study from the standpoint of the learner and also of the teacher at the same time.

The failure in teaching, when failure occurs, is oftener due to lack of knowledge of subject-matter than of subject method. And here let me say, the writer does not in the least degree disparage the value of methods of presentation, but he does believe that a somewhat thorough knowledge of a given subject must necessarily precede the method of presenting it.

Teachers will very generally teach as they have been taught. If students in training could have sufficient time, outside of the recitation period, for field work, laboratory work and library work, their methods of learning would serve them as methods of teaching. That method is the right method that leads a pupil to observe, compare, relate; that begets a spirit of inquiry and investigation; that enlarges his horizon, makes learning perennial, and increases his own usefulness; that leads him to see that the realm of knowledge is one realm, that one subject of study can not be isolated from all others, and that no subject of study can ever be finished.

Is this an ideal method? Call it so. May it be obtained? Why may it not be obtained? Under less adverse conditions this ideal should be realized through normal school teaching—not of the theory of teaching, but the actual teaching of the subject by the regular teacher in charge.

With this ideal for the teacher's aim, school geography will not in so many cases be a Sahara; the streams of thought will not shrink, shrivel, and dry up in waste-filled channels, but will flow on with increasing volume, and unite in one grand trunk which will make fertile the region through which it flows.

GEOGRAPHY FOR TRAINING STUDENTS IN NORMAL SCHOOLS

BY PROF. C. STUART GAGER, NEW YORK STATE NORMAL COLLEGE, ALBANY

It is the purpose of this paper to defend the following theses:

1 The teacher of geography should first of all be a teacher, second, a teacher of geography.

2 The preparation of the geography teacher should, therefore, progress along two lines: (1) principles of method, general and special; (2) principles of geography.

3 A firsthand acquaintance with the facts of local geography is essential to the clearest understanding of the geography of the distance.

4 The textbook study of the facts of geography to the exclusion of observational work, with the interpretation of the facts, characterizes the teaching of geography in the larger number of schools of the state.

5 The greatest need, therefore, in the education of geography teachers in normal schools is emphasis on the value of observational work, its place and purpose, how it should be conducted, and its correlation with textbook work.

To begin with, then, the teacher of geography should first of all be a teacher; second, a teacher of geography. The lack of professional standing for teachers needs no emphasis. The fact was well set forth by Rice in 1899. We have physicists plenty and geologists plenty; but of teachers whose purpose in life is primarily to be teachers, not scientists, and whose energies are centered in education for its own sake, and not wholly in the tools of education, whose interest is in the pupil and not wholly in the subject-matter, we have not a plenty![1] Only recently in a conversation, the principal of one of the high schools of the state said to me that, after all, he had about come to the conclusion that the "personal equation" is the chief factor in teaching. It was only another version of the "My method's the best for me" doctrine, the cut and dry plan which would not be tolerated for a moment in medicine, but which, somehow, seems to appeal to those who have never known anything better in pedagogy.

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[1] Butler. 1901. p. 104.

To be sure, the teacher must know his subject-matter. So must the carpenter understand his plane. The study of the subject-matter is as much a part of the preparation of teachers as is the study of education and method. Scholarship, in spirit and in fact, is absolutely essential, but the ability to teach is not implied by its possession. Special knowledge on the foundation of broad scholarship is as necessary in teaching as in law, medicine or theology. The idea that they are fitted to teach which is given young graduate students by the universities, just because they have pursued graduate courses in subject-matter, is a serious drawback in attempting to meet a demand for professional (pedagogic) preparation for teachers. The old maxim "learn by doing," so far as teaching is concerned, has been well brought into question by Payne (1898). If the experience of the past is to be of any value, the plan must be that of the old Greeks, "Learn, then do." Perfection of the art, as in any other profession, will be acquired later, and, if the teacher has a body of fundamental principles as a criterion for judging of his daily work, his future will offer to him opportunity, not only for experience, but opportunity to profit by experience. "Experience makes mistakes, and therefore is not the only guide, but must itself be guided."[1]

The primary duty of every institution which professes to do the work of normal schools or colleges, then, is to educate teachers, not to train them. To create a professional spirit by making clear the fact that teaching is not a performance that one can be taught to go through with as animals are taught to perform tricks, but a serious art based on fundamental principles, "the noblest of professions, but the sorriest of trades." It is one of the fundamental defects of normal schools, as Mace (1901) has recently pointed out, that they are attempting to do two things at once; to give the pupil both matter and method at the same time, giving only a review, instead of the new view of the subject which the teacher should have.[2]

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[1] Mace, 1897. p. XIII.

Let us now consider the teacher of geography. Here the greatest requisite, first and last and all the time, is a knowledge of subject-matter, combined with a knowledge of the principles of method. And this knowledge must be so broad and deep, and so abreast of the results of contemporary research, as to burst asunder the covers of any school textbook on the subject. The teacher who is unable to see, not only the day's lesson, but the work of the term, yes, of the whole course in its proper perspective, its relation to the subject as a whole, and to other subjects, and above all, to the life of the pupil, is poorly prepared for the serious vocation he has chosen. He must know the portion of the subject that he proposes to teach, not only from the standpoint of the pupil, but also from the standpoint of the teacher. This he can not do the first time that he pursues the subject. He must think it out anew with the class before him in imagination. He must know that with which the subject may begin, the way in which the subject-matter is to be presented, and the source of aid in such presentation, as field work, the topographic map, geographic monographs, reports, and periodicals. Both for his own sake and for that of his pupils, his resources must not be bounded by the limits of an introductory textbook.

The preparation of the geography teacher, therefore, should proceed along two lines. First, principles of method, general and special; second, principles of geography. He should be able to distinguish the study of method, which is the study of fundamental principles, from the study of "methods," which is a consideration of ways and means, devices, apparatus. He should realize that there are three factors in the teaching act, not two only. I have no sympathy with the doctrine expressed before this association two years ago, that "the training of science teachers . . . reduces itself to the formation in them of habits of serious experimentation, accompanied by reading and thinking about the subject to which they are devoting themselves." This is all very desirable, but the training of the teacher of geography or of any other science does not "reduce itself" to this. The teacher needs, in addition, to understand the fundamentals of method, such as the principles of interest, apperception, and self-activity. He ought to know the steps of an induction and their bearing on his work in the classroom. As a teacher he should think, not so much about the subject, as about the mental processes involved in thinking about the subject. His devotion should be to teaching first, to science second.

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[2] Cf. Harris. 1899.

Second, the prospective teacher of geography should know that this science is no longer a description of the earth, but a serious study of one set of facts and their relation to another.[1] First, the facts concerning earth, air, and water, and second the activities of living beings. He should be impressed with the fact that the present state of the lithosphere, hydrosphere, and atmosphere is the result of a series of causes operative, some of them in the past, and some of them at the present; that these conditions are not permanent, and that in their turn they are the causes of other effects. Unless he has found out some portions of the subject-matter as the result of his own observations and inductions, he should consider his preparation lacking in its most vital point. He will find his whole manner affected in presenting to a class any part of the subject if he knows some part of it at firsthand. His work will be characterized with a vividness and conciseness, with a lively interest and a confidence that can be acquired in no other way.

It is not necessary for the teacher of geography to be a *Forscher*, as the Germans understand the term. If he has found out a fact or a relationship new to him, the desired purpose will have been accomplished as truly as though the fact were new to science. Portions of the work outlined by Davis (1898, 1900), Cornish (1897), Snyder (1899), and the speaker (1900), are truly research work as far as the pupil is concerned, and such exercises should be a part of the education of the teacher of geography.

This leads directly to the third thesis, that a firsthand acquaintance with the facts of local geography is essential to the clearest understanding of the geography of the distance. This has been emphasized well in the writings of Geikie (1892), Davis (1898, 1900, 1901), and others[1] and needs only to be mentioned here. It is a corollary from the principle of apperception.

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[1] Redway. 1901; Dryer. 1897. ch. 2.

My fourth thesis is, alas, too easy to defend. The textbook study of the facts of geography, to the exclusion of observational work, with the interpretation of observed facts, characterizes the teaching of geography in the larger number of the schools of the state. I have taken a record of the preparation of my pupils for the past four years. These pupils are required to have had the equivalent of a high school course in physical geography before entering the normal college. I find from their records that over 95%, roughly estimated, have never been on a field excursion or had any other work whatsoever outside of learning what the textbook said. In other words, 95% of our high school pupils are studying *about* geography, while only 5% at the most are studying geography. The causal notion seems scarcely to have been hinted at in preparatory school courses. Similar conditions are described by Burrows (1900) who found that in 58 out of 121 schools the work was confined wholly to a study of textbook and map. No wonder that, when he inquired of these same schools if they considered geography of educational value, some of them replied, "Geography as taught at present has little value"; and "Of no educational value except as helping in history lessons"; or, more discouraging still, "You could not educate at all, in the sense of developing thinking powers, by geography."

I do not wish to be understood as considering that textbooks have no place in the teaching of the subject; but textbooks present generalizations which are mere words to the pupil unless he can bring to their interpretation some knowledge of the facts on which they are based. The problem, therefore, is how the teacher may equip the pupil with the necessary data by which he may most clearly apperceive the generalizations of the textbook. Time will permit only the merest outline of the work which the normal should endeavor to give the prospective teacher of geography.

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[1] Kelton. 1897; Dryer. 1897; Dodge. 1899; Merrill. 1900; Tarr. 1898.

First, a study of types in the field. It was only 100 years ago that Playfair demonstrated the causal relation between streams and valleys, and thereby solved for the world a hitherto unexplained riddle. There is, perhaps, not a school in the state where this demonstration may not be repeated, where a type study may not be made of hills, streams, and valleys, their present condition, their development, and their effect on human activities and industries. The origin and mode of formation of soil, the phenomena of glaciation, and the activities of village and city life, with their interpretation, may be studied at firsthand in almost any school, and this work should form a part of the preparation of teachers of geography in normal schools.

Careful attention should be given to the use of the material gained by observation; first emphasizing the fact that generalizations or concepts are reached only through special notions or percepts, and, therefore, second, how the knowledge of the home geography conditions the clearest apperception of the geography of the distance. Illustrative material, such as maps, models, and pictures, should be discussed, and the pupil stimulated to form the habit of voluntary reading and observation. Ability to represent by diagram or other suitable drawings the geographic form studied should be required.

Some of the most valuable work, judged wholly by results, that I have been able to give consists in taking pupil teachers who have studied about geography in textbooks into the field, where for the first time they are brought face to face with some geographic fact. The observed fact is then converted into a problem, and the proper solution sought. Three excursions I have found to yield unusually large results, and, though they may not be wholly new, I will suggest them here, since they may be repeated anywhere in New York state. The first consists in the study of the origin and mode of formation of soil, as illustrated in an abandoned quarry. The second is for the purpose of studying the formation and development of valleys of erosion as illustrated in hillside gullies and then in the larger permanent stream. In the third excursion attention is given wholly to a consideration of the evidences of glaciation in the home locality. These excursions have disclosed the fact that the pupils who have had a high school course in physical geography have little real knowledge and very vague images and ideas concerning the subject-matter involved. For them the out-of-doors globe does not exist. These excursions show also by their results what a world of new meaning the textbook and map come to have when viewed in the apperceptive setting which the field work makes possible. It seems almost trite to emphasize these truths any longer in our discussions, and yet the fact that pupils continue to come to the normal institutions in a majority of numbers without having had this work shows plainly enough that the subject has not been over-emphasized as an essential factor in the education of teachers. So late as 1889, in a book entitled *Normal Methods of Teaching*,[1] the subject of "methods of teaching" physical geography was thus disposed of: "Little need be said concerning methods of teaching the subject. The pupil will study it from a textbook and recite it." This would indeed seem humorous if it were not in reality so serious.

Prospective teachers ought to be more or less familiar with existing texts on geography, and know the criteria of a good textbook.[2] And last, but by no means least, there should be included the presentation and discussion of the most recent contributions to the science of geography and the pedagogy of the subject, to the end that the prospective teacher may be made to realize that the science of his teaching and the science that he teaches are not crystallized classified portions of knowledge, but living organizations whose most prominent characteristic is development and growth.

To state the matter concisely, normal institutions should be places, not where subject-matter is taught for the first time to prospective teachers, but places where one may learn how to make real to others that which one already knows. The ability to do this demands, first, that the teacher shall know as much as possible of his subject-matter at firsthand; second, that he shall know so much more than he expects to teach that neither the day's lesson nor the year's work will bring him close to the bounds of his own knowledge. He should find little in any elementary textbook on which he can not throw a flood of light from his own investigation and wider reading. And third, and most important of all for the teacher, he should understand the mental processes involved in learning his subject, so that, while the pupil is thinking the subject, the teacher can think the pupil's thinking of the subject. This will result in securing to the pupil the maximum of discipline at the same time that he is enlarging his knowledge and broadening his culture.

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[1] Brooks. 1889. p. 484.

[2] Blodgett. 1889.

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[The third paper was given without notes by Prof. C. T. McFarlane, principal of the state normal school at Brockport. Prof. McFarlane emphasized the necessity of devoting special attention to the relations of life, specially human life and occupations, to the environment, and expressed his belief that a knowledge of the physical controls of life could be taught as well by analyzing the life conditions of selected regions as by beginning with physical geography and ending with the life conditions dependent thereon.

The last paper was by Prof. Will S. Monroe, of the state normal school at Westfield Mass., who outlined the possibilities and necessity of teaching anthropo-geography in normal schools.

An animated discussion followed the papers, to which Frank Carney, of the Ithaca high school, Prof. Albert P. Brigham, of Colgate University, Professors Gager, McFarlane, Monroe and the chairman contributed.]

Section D. NATURE STUDY

WHAT IS THE MINIMUM NATURE STUDY TRAINING FOR A TEACHER IN AN ELEMENTARY SCHOOL?

BY SUP'T DARWIN L. BARDWELL, BINGHAMTON

The discussion of the minimum or of any of the requirements for teachers of nature study, practically supposes that one's mind is made up respecting the field of nature study. It is not my intention, and evidently not the intention of the originators of the program, to call for a discussion of that side of it. You will see that what I have to say will come out of an understanding of what is the proper province of nature study. I have in mind two lines of needs. In the first line of needs, one thing; in the second line of needs, more than one.

For the first. In some correspondence which it has been my privilege to have with teachers, directors and supervisors of nature study in different parts of the country, I received Christmas morning a letter from a supervisor of nature study work in one of the smaller cities of Ohio. He is new in that field, and we have had some correspondence regarding the work he is trying to do in that city. In this letter he said he found that the greatest weakness was the need on the part of his teachers of some experience in nature study itself. That is the first need I wish to emphasize—a need of practical, actual experience. So far as this vital experience is concerned, it is not much matter in what field it is obtained, but it must be in some field if the teacher is to be a successful director of nature study. A teacher who has never traveled outside his town can not teach geography in any but the very poorest manner. He must have had a wide range of experience, personal experience so far as it can be obtained, and his personal experience supplemented and augmented by what he learns from the experience of other travelers in wider fields. The same may be said of the teacher of nature study.

The second line is a basis of material information—facts—something that shall be a stock in trade, materials with which to work. Here I shall speak along three lines.

First, the teacher of nature study must have a fairly intimate acquaintance with the more evident phenomena of the weather and climate in the particular section of the earth in which he lives. It is a common saying that anyone can talk about the weather. Not everyone can talk intelligently about the weather. A fair understanding of some of the more evident facts controlling the weather is highly imperative. Something of an understanding respecting winds, atmospheric pressure, the laws which control the phenomena of erosion and deposit, is an essential portion of a teacher's stock in trade, if he is successfully to carry on this section of work, which it seems to me is properly classed with nature study. To this end, he needs to be pretty fairly familiar with the subject-matter contained in certain sections of any good textbook in physical geography and with the more manifest laws of physics, including pneumatics, hydrostatics, and heat. He needs to know beyond the possibility of question, why it is and how it is that a large body of water helps to keep the general atmospheric conditions more stable and the temperature more uniform throughout the 12 months of the year, than is the case in a section where there is no large body of water. He knows these things because he has investigated them to a certain extent, because he has carried on, in a limited yet true and effectual way, some little experiments pertaining to that sort of thing.

Another need is a vital, intimate acquaintance with certain forms of plant life surrounding him—in short, the old-fashioned botany. I have nothing to say in objection to the microscope in the study of botany. But laboratory work in botany is not a *sine qua non* for the teacher of nature study. It may be a good thing, an excellent thing. It helps to widen the horizon, and may be used with considerable success, or it may be left out entirely and the teacher not be very badly handicapped so far as nature study is concerned. But it is highly imperative that the teacher shall have a clear understanding of a plant like the hepatica, its life history and the laws controlling its life; shall understand something pertaining to the method of inflorescence; in short, he wants to be on good speaking acquaintanceship with the hepatica type of plants. Then he wants to have his range large and his study intimate, so that he can pick up a new flower, belonging to the same family for instance, and by an examination of 10 or 15 seconds will be able to say beyond question that it belongs to the same family. He wants to understand the life and some of the properties and the value to men of some of the vegetables as they are found in this portion of the world. He needs to know how to look at the ordinary tree found in this region, and to see what it has to tell him as it stands by itself. It will tell him in an instant of certain laws. He should be able to tell clearly and at once certain of the great industrial values of certain classes of hard woods. These will be stock in trade, and from these he can amplify and enlarge.

He also wants to have a good, clear familiarity with the fauna surrounding him. He needs to have an acquaintance with a book like Hooker's *Natural History*. Get the study with the microscope, if possible, as that is excellent. It will greatly assist the nature study teacher in the grades; but I would much rather that one of my teachers should know the life history of the toad than to know the structure of the particular ganglion in the toad's anatomy which must be tickled to make the toad jump. Live animals he wants to become familiar with, and not dead ones.

In addition to that, he requires a more intimate acquaintance with certain families and certain types. A more extended study in a certain department, insects, for example, might be had. The same might be said respecting other classes, birds, for instance. It is not necessary, to my mind, that he should know birds and insects intimately, but, in addition to the general knowledge, he should know something quite intimately respecting a few individuals of one of these classes. If it is insects, he should know pretty clearly the general laws of the best classification, so that, if he takes up an insect he has never seen, he will be able to tell the division to which it belongs. There is thus born within him a certain consciousness and power, reserved and actual, which comes from that kind of intimate acquaintance and which goes farther than we can estimate, which helps to arouse enthusiasm, and which makes the child walk safely and with a sure advance into other realms of which less may be known.

So he wants to know something of the life history of certain of the other forms of insect life, as they surround him: what is back of the particular event which occurs when the June bug, or May beetle, comes up to the window and asks to be let in after the lamps are lighted at night.

Have I made clear the field which the teacher of nature study wants to be made familiar with? If he is familiar with these things before he enters upon his work, well and good. If not, they should be made familiar. I have placed them as a minimum.

I am aware that many teachers and most excellent teachers come with less requirement than this, but I take it that it is not our business to encourage the employment of people before they are fairly well equipped to earn a salary. It is not our business to encourage the employment of people till after they know enough, and have acquired enough power to go ahead and work with a considerable degree of sureness and effectiveness. The inexperienced teacher has much to learn; the best have much to learn. But there must be a certain minimum or there is a vast deal of friction, loss of time and energy, and nervousness in worrying about results.

There shall be a basis of actual experience with something. There shall be an acquaintance with facts pertaining to the more evident phenomena of the world around us, including physical geography and physics; in botany, including a familiarity with the general characteristics of the more common types of plants, like the rose, buttercup etc.; and a similar study of the more common forms of animal life as they occur about us.

Mrs Mary Rogers Miller—The design of this program was not made entirely clear by the statement of the subjects in the printed form. Since the training of teachers is that part of the nature study movement in which I have had the greatest interest, I desired to put all of our attention on that particular point this afternoon. I wanted a basis from which we could work; so I asked Prof. Bardwell to give us his idea of the minimum training in nature study that should be required of a teacher before entering on her duties in any school. I had not in mind a teacher who was expected to devote her time to nature study; but the fact that we don't seem to be quite on the same platform does not make me unhappy. I told several people that I hoped we should not all agree, and that each might go away with a bee in his bonnet and something to think about for a year at least.

What I want to have you think about specially, if you will, is the teacher who is going to teach in your school, if you are a superintendent, and of whom you wish to require some nature teaching. What are you going to expect of her? Prof. Bardwell, I think, may have in mind a teacher who is going to teach nature study only.

Sup't Bardwell—I have not, no ma'am.

Mrs Miller—I am set right. We will go on with the next. My notion was that, after Prof. Bardwell told us what we ought to expect of the teacher, we should consider this question: Where is this person who expects to become a teacher in the future going to get nature study training? Where and how? I have selected for this part of the discussion several people in whom I have confidence. The first is Miss Elizabeth Carss of the Teachers College, New York. Miss Carss will tell some of the trials and tribulations, as well as of the successes of a nature study supervisor.

WHERE AND HOW CAN NATURE STUDY TRAINING BE OBTAINED ?

BY MISS ELIZABETH CARSS, TEACHERS COLLEGE, NEW YORK

The necessity for training in nature study can be seen by an examination of a large number of outlines of courses of study for elementary schools. In nearly all public and in a large number of private schools some kind of nature study is required.

The interpretation of outlines of nature study is often difficult, as only a few broad headings are given, and there is no relation between the subjects selected and the other work of the grade. This indefiniteness is frequently due to the lack of understanding of the educational value of nature study in the school curriculum. The teacher is usually left to interpret the course for herself, and, unless she has the right training to help her in this, the result will often be unsatisfactory. When I say right training, I do not wish to imply necessarily a long specialized study, but rather some intimate knowledge of natural objects, as was suggested in the preceding paper on minimum requirements. The great difference between the demand made on the elementary teacher of nature study and the high school teacher of science is that, though nature study should have a scientific basis, it must touch on many subjects, and should serve to start within the children a lifelong interest in the world about them, while high school teaching calls for a clearly defined course in some subject, hence a thorough knowledge of the subject-matter.

If we grant that teachers should be fitted to bring nature into the schoolroom, the question naturally arises: Where can such training be obtained?

There are several reasons why colleges and universities can not be called the best places for training for nature study teaching. In the first place, the training of the professors and instructors is not that which would lead them to understand the needs of children of the grammar school age. In the second place, the work given in the universities is not accessible to those who are training to be elementary teachers. The great value of college courses in science is that they give scientific method of thought and work; and for those who, after years of teaching, wish to take up special supervision of nature study, such courses are almost indispensable.

Summer schools have aided many teachers who could afford to attend them. Nearly all state agricultural colleges have opened summer schools, in some cases free of charge. Among the larger universities that have definitely announced summer courses in nature study are Cornell, Columbia and the University of Chicago. The value of these courses is that they enrich the fund of subject-matter and give new method of work. The drawback to the value of the work is that the materials studied in the fields during July and August are not those that can be seen or studied in the school year. The summer courses do not usually suggest winter work, and the environment of the school in which the teacher is situated is often very different from that of the summer school.

Extension work done by agricultural colleges, specially by the bureau of nature study at Cornell, has been of inestimable service in directly stimulating the children through correspondence and in extending information and suggestions to the teachers by means of leaflets.

We must look to the normal schools for the large supply of elementary teachers, and should therefore expect to find training in nature study in these institutions. How is the demand met in general by the normal schools? After examining 60 catalogues, none of which was earlier than 1899, I find that without exception some course in elementary science is offered. Physiology is almost invariably required, and the aim, as often stated, is to fit teachers to give the necessary instruction required in the public schools. The courses given at the normal schools differ widely in character and may be classed under two heads: (1) those giving elementary science and laying no stress on application to teaching; (2) those making such application the main consideration. Under the first heading, the usual courses are, one half year each of botany and zoology, often the same amount of chemistry and physics, and frequently mineralogy or geology in addition. These courses are often elective, but sometimes nearly all those mentioned are required. It must be said that these courses, in some cases at least, fail to furnish the student with either suitable subject-matter or good method of work. In botany and zoology students are often given close analysis of parts or the study of minute structures before they have any acquaintance with the function of parts or with the environment and habit of the plant or animal studied. Under the second heading, where training in teaching is considered of greater importance, I have found the following plans suggested: (1) subject-matter taught in the grades to be studied by the normal students with daily observation of the school work, also the preparation of lesson plans, and lectures in the history of science; (2) the subjects taught in science grouped under the heading, " nature studies ", including botany, zoology, physiology, chemistry, physics and geography; (3) elementary courses in science which aim to be guides for nature study teaching, with apparatus planned with a view to its value and simplicity for schoolroom demonstration; (4) courses in method of teaching elementary science as supplementary to regular science work.

From the observation of work in a number of normal schools and a knowledge of the preparation of many normal school graduates, the following general criticisms of normal school training in science are in a number of cases justifiable. (1) The work has often been so unscientifically presented that students have not an accurate knowledge of even the elementary facts. (2) Too many subjects are taken up in a short space of time, and this leads to scattering, hence students do not acquire the power of handling a new subject. (3) Nature study has not been considered as equally educational in value with other subjects, therefore, sufficient attention to its underlying principles has not been given. (4) The suggestions given in method courses for this work are often too formal in character and, when applied to the schoolroom, produce dislike for the subject among the children.

Teachers come to the elementary school in a large number of cases with absolutely no desire to teach nature study and with very little knowledge of how to go about it. Yet many school boards require it, and principals insist that it be carried on. Here the function of a supervisor of nature study is most important, for, if she understand her work, she may give teachers the very best kind of training for nature study teaching.

What are, then, the requisites for a helpful supervisor? Of first importance is a thorough knowledge of children and school work. (2) A good training in several sciences, more specially biology, physics and geography. (3) Abundance of original observation of the habits and haunts of animals and plants—the natural history point of view. (4) Thorough understanding of the educational aims and purposes of the subject. (5) Insight to understand how to help untrained workers and to utilize the knowledge of teachers of experience and some scientific training. (6) Wide knowledge of books suitable to aid teachers and for children's reading. (7) Knowledge of how and where to secure material.

Provided the supervisor be thus well equipped, what is the work before her? In the first place, to outline a course of study that shall be suited to the children and to the locality, sufficiently flexible to permit of a certain individuality in the work of each room, sufficiently detailed for clearness, correlated with other subjects where correlation gives strength to all subjects concerned, and arranged, as far as possible, to avoid overlapping of topics from year to year. In many outlines I have found a direction such as the following: "During the autumn, study trees, buds, twigs, flight of birds, etc., for all grades". In one school I found three different grades studying the germination of the bean. The lowest grade of the three was interested, the others acted as if they were utterly weary of the bean and its germination. Children should not be kept back in nature study any more than in any other subject.

After the plan is made on paper, there comes the difficulty of carrying it out. To do this, the supervisor must first get the cooperation of her teachers. Meetings with all the teachers in a school may be held, and the plan of work thoroughly explained to them, and reasons given for the selection of topics. Suggestions from the teachers should also be sought. If possible, give talks on the educational principles, subject-matter and schoolroom devices of study. Meeting with the teachers of the separate grades is valuable; for here the outline for the grade can be specially discussed, difficulties answered, correlation of work planned for. The supervisor should occasionally give a lesson to the children and encourage them by taking interest in their work and the specimens in the room, and, if possible, occasionally conduct a field excursion to some neighboring locality. After the observation of a lesson by the class teacher, the supervisor can often give helpful suggestions, though tact and judgment are here necessary. The criticism should touch on important points or it becomes valueless. Material that is almost impossible to be obtained should not be required. In any case, the supervisor should be able to tell where either pupil or teacher may get it, and in some instances should provide it. The task of supervision of nature study is a difficult one, requiring energy, resources and sound training in science. No one, however, has a greater opportunity to improve the work in nature study than the supervisor who comes in direct contact with teachers and pupils.

After one or more courses in elementary science, students in some of the normal school courses at the present time are assigned for observation and practical work in the school under the direction of the supervisor of nature study. If this work in the practice school is to be of any great value to the students, it should be carefully planned. The following arrangement has been found to produce some very encouraging results. The aims of nature study and the principles on which the work is based are fully discussed with the students, and a brief review of what has been accomplished by others in this subject, is given. As far as possible, both the merits and defects of various schemes are discussed. The outlines of nature study for the school in which they are to observe are explained. Before the observation, they are given instructions in arranging lesson plans, and are required to prepare plans which will show how they would teach the lessons they are to see, suggesting materials, illustrations, etc. The lessons are then observed, and a careful written report of them required. The students are brought together for a discussion of the preliminary plans and the report of the observation. In this way the student compares her work with that of the teacher, and points of weakness or strength in preparation and presentation of subject-matter, method of questioning, use of illustrations, etc., are brought forward.

After such observation, students are given a chance to become more intimately acquainted with the work, by assisting with it. They may be assigned to direct a group of children on a field trip or in garden work, if there be a garden. Students may also be assigned to special rooms, where they are to become acquainted with the children, and suggest ways of collecting and caring for living specimens of plants or animals in the schoolroom. Finally, the student may teach a series of nature lessons in the room where most of her practical work has been done, and where the children are best known to her.

It is true that such a plan calls for a great amount of thought and labor, but, if carefully carried out, it will give the student an invaluable knowledge of the difficulties and possibilities of conducting such work, and will give her a means of measuring the result of her work with that of others. Errors can be directly pointed out, and valuable or original ideas tested.

Mrs Mary Rogers Miller—Among the various places where teachers are trained, we have training schools and training classes. If nature study is a good thing, and most of us think it is, or we should not be here today, we want to call to account some of these training schools and classes and ask them what they are doing to prepare their students to do the work we want done. Miss King is going to tell us what they do in nature study in a training school.[1]

Mrs Miller—Before we take up the third division of this afternoon's work, I want to ask Prof. Sheldon to speak of the normal school nature study.

Prof. C. S. Sheldon—I came here to get information and to get suggestions in regard to my work for the ensuing term. All I know at present with regard to nature study work as it has been done there, is that there is a class in nature method 20 weeks each term. It is repeated two terms in the year. Students are obliged to take the nature method just as they are obliged to take 20 weeks in geography methods. Twenty weeks are devoted to the preparation for the work of nature study. The conditions are more favorable than in some of the largest cities in several ways. We can go out during recitation period or with teachers in method class and observe for ourselves at any time when the weather is good, and return in time for the following recitation. Three quarters of an hour will give us a good basis for future discussions and plans. Teachers in the practice schools are not all of them, of course, teaching nature study at any given hour during the day. We generally select those to teach this work who have been best prepared and show the greatest interest.

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[1] Miss King did not submit a manuscript for printing.

It occurred to me that there is one thing that sometimes I fear we, even as teachers of nature, forget, and that is that the main object in teaching to be sought for is not the imparting of subject-matter, but the creating of ideas in children, and to this end it has always seemed to me that the first requisite is a very live interest in the teacher herself. I say herself, for we have 10 ladies to one gentleman in our own normal school, and the proportion is increasingly larger in many of the normal schools today.

I am not prepared to make any talk on this at all. I was merely taking notes on the ideas presented, thinking I might be able to make some more definite changes. In the future, I may have more experience to guide me.

Mrs Miller—Then I understand that in the normal school and training school, students have a foundation of scientific knowledge before they begin nature study? That you plan to adapt what they have gained of science knowledge to the nature study teaching? I would like to know how it works out.

Prof. Sheldon—I wish to say that there is one difficulty in preparation. Many of the students in coming to us have evidently had their training in science elsewhere, and we are expected to accept a certain amount of such knowledge from other schools. Frequently we find that such knowledge is lacking, though they have passed the requirements in the Regents examinations. Such knowledge is lacking, and they are sent back into the work in biology to prepare themselves more thoroughly.

Mrs Miller—Is there no such thing as teaching nature without technical science? And is not a mistake made in teaching science without nature? I know people filled with science who seem to know very little of nature.

Prof. N. A. Harvey—Folks come poorly prepared in the subject-matter. I know it is not any credit to a teacher in any grade to complain of the work in the grade below. But many amusing things have come within my observation recently. One girl was going over to teach a class one day last month. I was walking with her, and talking about her work. She suddenly thought about something. She said, "Does the moon rise?" "Why," I said, "yes, the moon rises." I think questions about the moon were involved in the subject she expected to teach. She said, "Does it set?" I said, "Yes, the same as the sun. Didn't you know it set?" "No, I didn't know the moon set." "Well, you have seen the moon in the sky?" "Yes, I have seen the moon." "How did you suppose it got up there?" "I never thought about it." That is a striking illustration, though it is no reflection on the intelligence of the girl. She was a bright girl.

In a class for the study of insects not long ago, one girl, one of our brightest students, said, "I can't find the sting of this bumblebee. I have looked on the head and I have looked on the wings and I have looked on the abdomen." "When you were teaching your class about bees, what did you teach about the sting?" "I taught that that was the sting" (pointing to the tongue).

A class were studying the katydid. They had all read stories and poems about the katydid. When it was first presented to each member of the class, I asked what the specimen was. At last some one said it was a katydid, and a murmur of surprise went over the room. One said, "I thought a katydid was a bird!" I asked how many thought so. Eleven in a class of about 50 thought that the katydid was a bird. That was true in three different classes where I inquired in that same day.

These things tell nothing about the kind of work that has been done in the high schools. They do tell about the condition of the pupils and the knowledge of the girls that come to us to teach.

I went into a class in the 7th grade one day. The teacher was teaching about a moth. She had a good plan and was presenting it in a good way. The pupils were not paying attention to the work. The reason for the lack of interest was that that same moth had been the subject for a lesson in a number of the lower grades, and they had lost interest in it.

Mrs Miller—We all agree that it is not the amount of information, but the training one gets from the finding out that is of value. Yet I wonder how many teachers can resist the temptation to "tell it" when they know it? It is one of the hard things to learn.

[Here followed an informal discussion of the subject, in which the previous speakers, and Prof. Spencer of Cornell and Sup't Young of New Rochelle took part.]

Mrs Milller—Mr Beach of Buffalo has a plan to present for teachers' nature study classes.

SUGGESTIONS FOR A TEACHERS CLASS IN NATURE STUDY

BY CHANNING E. BEACH, BUFFALO SCHOOL 23

The following brief outline of work for a teachers nature study class has been prepared with special reference to the teachers of city schools, and it will consider the class as a means of meeting those difficulties which confront a city school teacher when he attempts work in nature study.

Briefly, these difficulties can be arranged under two heads: (1) lack of knowledge, (2) difficulty in obtaining material for class work.

In introducing a relatively new subject like nature study into the school curriculum, we are confronted by the fact that many excellent teachers now employed have had no adequate preparation for giving proper instruction in that subject. Where nature study lessons are optional with the teachers, many still hesitate to begin because of their lack of knowledge. Others, having begun the work, feel the need of more assistance than can be derived from books. But a relatively small number of teachers can spare the time and money to attend the summer schools and obtain instruction there; and it is to meet the needs of these city teachers without interfering with their regular work that teachers classes in nature study have been planned.

The factors to be considered in organizing such a class are three: a well qualified leader, interested teachers, and the subject-matter.

The success of the class will depend primarily and chiefly on the leader; and it may be well to enumerate some of the qualifications for that position. He should possess a fund of accurate information regarding natural objects, specially their habits, life history, and environment; and a general knowledge of their scientific classification and nomenclature will be of service but not essential. The wider his range of knowledge the better, because nature study is not limited to any one of the natural sciences.

He should be thoroughly acquainted with the locality, that he may choose the best places for the field trips. He ought to possess the traits that make a good teacher. But, above all, he should possess a love for nature, that subtle instinct and finer feeling which swell the heart with thoughts beyond expression and draw one irresistibly into the open fields and whispering woods. This he can not impart, but fortunately it is contagious. Among the teachers in every city there is undoubtedly some one interested and informed in scientific matters who would be willing to aid his fellow teachers. The members of this association might give some of their time in this cause, as it will assist in the advancement of science, which is one of the aims of our association. If there happens to be a local scientific society, some of its members might act as leaders, or the society might be induced to take full charge of the work. If it be impossible to secure a leader who meets all requirements, it will be necessary to apply a synthetic method and get the best of several different personalities.

Let us consider, now, the class, its formation, composition and size. It may be begun on either side—the class may organize and choose a leader or a leader may appoint himself and advertise for a class. It would be better however if some organized society, or even the local school authorities, took the matter in hand.

The size of the class is important. If too large, time is lost, and the whole class does not get the full advantages of the work. If too small, the leader will be obliged to supply all the energy which keeps things moving. From experience in such a class, I think 20 are too many. Ten are a good number, enough to keep up the interest, and not too many for a good leader to keep together. In case the class should wish to visit a locality not accessible by trolley, the railroads will make a reduced rate for an organized party of 10.

Before discussing the plans for class work, it is necessary to decide what the *aim* is. As I understand it, our aim is a practical one, and it is to enable teachers of city schools to obtain material for use in their classroom, and to give them the knowledge and directions which will enable them to employ this material to the best advantage. If this practical side of the question is well carried out, the more ethical aim will be acquired unconsciously.

To obtain the necessary material, field trips are necessary. The field trip must be carefully planned. The leader should be acquainted with the territory visited; and it is usually advisable for him to explore the spot a day or two in advance to make sure that specimens worth collecting will be found. He should decide in advance what will best suit the needs of his class, having ascertained that it may be obtained, and be prepared to give its most interesting habits and characteristics.

The apparatus necessary will depend on the material to be collected; but some receptacle for plants and insects, a pail for aquatic life, and a net for insects and for dredging are essential.

The problem of transportation usually can be met by using the trolley cars. On arriving at the chosen ground, the plan of work should be carefully explained, if it has not been done before, directions for collecting should be given, and attention be directed to the points of general interest, such as soil, environment, and general relations.

Then, having prepared his class, the leader will lead them to the places where the chosen material is, and see that each one obtains enough for practical purposes. The class should, at the same time, study the habits and characteristics of the plant or animal collected, and also note the environment, that they may reproduce that condition in the schoolroom as far as possible. A little care at this time will save much trouble and may prevent disappointment later.

It is impossible for anyone to explain all that may be seen in even an hour's trip through the woods and meadows, and that is the reason for emphasizing one particular point. At the same time, the leader can and should call attention to some of the delightful and interesting features which present themselves.

A bird's nest containing eggs or young, a squirrel or chipmunk chattering in the trees, a stately old tree or some humble insect, may afford an opportunity for the leader to give his class a bit of real nature study in the field. It is pleasant to sit down on a convenient bank and enjoy the beauty of the hills and meadows, the color of the foliage with its beautiful greens in the spring and its splendid hues in autumn, the sky and clouds and to listen to some of our wild birds singing their sweet notes of freedom. All this is pleasant and profitable; but it should not prevent the accomplishment of the work planned, because a teacher can not arouse much permanent interest in his class of 40 or 50 children by telling them what he has seen, no matter how deep his feelings may have been; but, let him place before his class something they can see and study for themselves, then will those pupils share his pleasure.

When the work in the field has been finished, the class should be assembled, the day's work carefully reviewed, and directions for the preservation of material should be given. Saturday is the most convenient time for a class of teachers to make a field excursion, but the necessity of keeping the collected material 36 hours before using it is a great disadvantage. In collecting, this fact should be kept in mind, specially if flowers are to be gathered. If it be possible, it would be better to have the trip in the afternoon after school, but there are practical objections to that plan also, chiefly the question of time.

At this general summary of the events of the trip, the leader will have an opportunity to answer the questions which the class have to ask, and he is a wise man who can answer even a fourth of those questions.

This briefly is a plan for a field lesson. It should follow the same fundamental principles which underlie instruction in any subject.

Owing to the infinite variety of conditions which will be met on field excursions, I have not entered into the details of such a trip; but have tried to sketch broadly a plan which would apply to any field work, whether the object were to collect pollywogs or hepaticas. Yet it may be profitable to mention a few of the things worth collecting for use in the schoolroom and suggest some general lines of study for the class of teachers. The distribution of plant and animal life, noticing what things prefer certain conditions, as a swamp, hill, woods, etc., the effect of environment, which is very noticeable in plants; the struggle for existence; the action of the physical forces of nature; the relations of different forms of life, as exemplified by the familiar relation between bees and pollination—all these and many others are fruitful subjects for study and observation, and are also practical.

In the autumn months the dispersion of seed and the preparation for winter are the most striking phenomena, and material illustrating them can easily be procured. Goldenrod, asters, the autumnal leaves, the berries of the bittersweet, or a branch of the thorn apple bush, as the children call it, etc., will beautify a schoolroom wonderfully. The dead and dry weeds, such as the teazel and the yarrow, are excellent for drawing lessons. This is the time of year to collect cocoons, specially the cecropia, to be kept till the spring. When the leaves have fallen, it is easy to find the nests of the birds, which have been so carefully hidden, and can now be taken and kept for use when the time comes.

In the spring the first excursion should be made as soon as the weather permits; and the roots or bulbs of some of our early wild flowers can be taken, and, if potted with a little care, the plants will blossom in the schoolroom. Hepaticas, squirrel corn, violets and trilliums take kindly to this treatment. It is an excellent thing to have a wild flower garden if the school yard permits.

Crawfish, insect larvae, newts, toads eggs, and small fish can be obtained for the aquariums.

But, in collecting, see to it that our rare and beautiful forms of plant or animal life are not exterminated; but choose, rather, those forms which are so abundant that the number taken will not affect the species unfavorably.

The Cornell leaflets for teachers are invaluable in this work and can be obtained with little trouble.

In concluding, let me review briefly what has been said. The class is for the benefit of the teachers, and its first aim is to meet their needs in a practical way. To obtain the best results, the class should be of a convenient size. The work of each excursion should be planned in advance, care being taken not to attempt too much. The plan should be pedagogic and, barring accidents, should be followed. The leader should see that each member of the class gets the full benefit of the work. The burden of responsibility will fall chiefly on the shoulders of the leader, and he must be chosen with care. If you can find a the spring and its splendid hues in autumn, the sky and clouds and to listen to some of our wild birds singing their sweet notes of freedom. All this is pleasant and profitable; but it should not prevent the accomplishment of the work planned, because a teacher can not arouse much permanent interest in his class of 40 or 50 children by telling them what he has seen, no matter how deep his feelings may have been; but, let him place before his class something they can see and study for themselves, then will those pupils share his pleasure.

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Saturday morning, December 28

SECTION MEETINGS

Section A. PHYSICS AND CHEMISTRY

COLLEGE ENTRANCE PREPARATION OF STUDENTS AS VIEWED FROM THE SECONDARY SCHOOL MAN'S STANDPOINT

BY PROF. R. J. KITTREDGE, SCHENECTADY UNION CLASSICAL INSTITUTE

In dealing with this subject we may perhaps properly consider it under three heads: first, college requirements in physics for entrance and efforts of the preparatory schools to meet these requirements; second, physics as related to other subjects in the college and high school curriculum; third, certain comparisons between the scientific and classical methods of instruction, and suggestions for betterment.

First then, what are our colleges requiring for entrance, and what are the preparatory schools doing to meet these requirements? To answer these questions, I have examined the entrance requirements of some 20 of our leading colleges and the courses of instruction of a number of our preparatory schools. Some of the colleges have in physics no entrance requirements at all, as they have no scientific course, or at least nothing more than a very limited instruction in science. Some others demand one year of a combination of textbook work and laboratory work, as indicated in some one or several of the textbooks designated. Some require no laboratory work at all, but those that require it require a notebook with at least 35 or 40 experiments performed by the candidate. Where a list of special exercises is called for, the majority of the colleges ask either for the Regents list or for that of the National Educational Association, taken directly from the book of Hall & Bergen. In the former list we have 66 experiments, or rather groups of experiments, for many of them contain a number of subdivisions, each one of which may be considered a separate experiment. Many of these experiments are elementary; but they give a fair list of the fundamental laws of physics, while they do not make sure that the applicant has actually performed any laboratory work. In the second list we have 61 experiments from which to select. These are in general somewhat more difficult than those of the Regents list, in that they require more costly or more intricate apparatus, though about half of them cover the same ground as those of the Regents. They omit some subjects usually placed in such lists, notably the pendulum and some of the simple machines as well as the more simple laws of strings in acoustics. Some things are demanded under the subject of electricity and magnetism that are difficult to perform and unsatisfactory, when performed. The demands can be classed as higher than the Regents' work, requiring, as they do, more maturity of mind for the handling. These two lists can however be so used by proper selection as to give a year's work that will satisfy both requirements. This is that which I have attempted in my own class work and with fair results.

Now what are the secondary schools doing? I find that they nearly all offer physics in their science courses and are thus in advance of the college requirements. They provide from one half year's to two years' work in physics and that in the latter part of the curriculum. The great majority of the secondary schools have one full year, combining textbook with laboratory work. So much for the subject of physics as we find it in the high school and as a requisite for entrance to college.

We reach the second part of this paper: How is physics related to other subjects in the curriculum of the college and the preparatory school? Let us take a comprehensive view of the case and see just what is being done along the general line of science. Scarcely two colleges, we find, have the same entrance requirements. Some require a science for entrance to all courses; some require three sciences for the scientific course; some two; some one; and some offer such a course but require no science at all for entrance. Indeed even a technical school, we find, that requires neither Latin, Greek, nor science of any kind for entrance. And the condition in the preparatory schools can hardly be said to be better than that in the colleges. In order to make comparison the more easily in this matter, I have tabulated the subjects taught and the time in years devoted to each subject in a considerable group of our high schools and academies, as follows:

Physics	1	½	1	1	1	1	2	1	1	1	1
Chemistry	½	½	.1	1	1	1	2	1	½	0	1
Physiology	⅓	½	1	½	1?	½	0	⅓	½	0	⅓
Physiography	1	0	½	½	1	½	0	⅔	½	⅓	⅓
Botany	½	½	½	½	1	½	0	⅓	0	0	⅓
Zoology	½	½	0	½	1	½	0	0	½	0	⅓
Geology	0	½	½	½	1	½	0	⅓	0	0	⅓
Astronomy	0	0	0	0	1	½	0	0	0	0	⅓

Though this is a limited list of the high schools and academies of the country, yet I believe that it gives a fair illustration of the general method that obtains in the secondary schools. We see that they are trying, at least, to do a pretty large amount of work in the sciences and are teaching in eight separate subjects, giving from one third of a year to a full year to each subject. There is one notable exception to this general rule, and that is in the school which gives two years each to physics and chemistry and makes no attempt at any other science subject.[1]

For comparison's sake, I have made a table also of the language subjects as taught in these same schools.[2] I have omitted English, as I take it for granted that most educators are agreed that English should be taught for four years in all the curriculums. We do not therefore need to enter it in the comparison. You will notice the unanimity in the requirement of four years of Latin and three of Greek with the option of two or three years each of French or German. I have failed to find any school, in the somewhat limited list of catalogues at command, that attempts another language. (It is possible that in some the Spanish may recently have been introduced.)

We all know that there are students who, so to speak, take naturally to the languages, as a duck to water. We know also that the reverse is true, that there are students who dislike the classics and are fond of the sciences. Of course, we have certain students who are good in all subjects and others who are poor in all. The great majority, however, appear to have a special and natural appetency for some one or perhaps two of the great departments of knowledge: language, science, mathematics, history.

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[1] Since writing the above, I find that the high school in Chelsea Mass. offers four years of physics.

[2] This table was not received up to the date of printing.

That the greater number of students take Latin is well known to all educators. Now the question arises: Is this because the students themselves prefer it or because they are otherwise influenced to take it? Latin holds, and has long held supremacy in the field. It is one of the most thoroughly taught subjects in our schools. It may be regarded as one of the more difficult studies. Is it the prestige of the Latin, or the impression of its superiority as an educative study, or the acknowledged ability with which it is taught, or the pressure brought to bear by parent or teacher on the student, or the inherent difficulty of the study itself—one or all these—that goes to influence the student in his choice? Much as a belt runs to the higher part of a pulley, so the student seems to tend to the harder and more thorough lines of education. This is of course natural to the better, the strenuously constituted class of students. But the fact remains, account for it as we may, that most students take the Latin.

I was speaking with a classical man not long ago about this matter. He said: "You science men don't know what you want." Perhaps we don't. Then we should find out. We should determine what is best for our department and clearly and unitedly make our demand for that best thing. How our classical friends would smile if we should lay out a course for them with one year for Latin, one for Greek, one for French, one for German, and a half year each for Spanish, Italian, Russian, Dutch, and then fill in what remains with science! Yet how does that essentially differ from their arrangement of our own science course? They allow a year for physics, chemistry, physiography, biology, etc., arrange for electives in as many more, and fill in with from one to three languages.

Why should not the scientific student ask and receive just as thorough and complete an education as the classical student? Is it because of any essential difference in the nature of the subject? I much doubt it; indeed, I am impressed with the conviction that, if a person pursues a course in science similar to the present language course, he will come forth from that course in ability in his chosen field the equal of his classical brother in his chosen field. We promptly admit that some need special classical training. Not a word would I speak against that training. I am only speaking my word for a precisely corresponding scientific training. But there is this other distinctive class that demands the sciences and not the languages. Are not we who have these minds in charge for the next generation, wronging them if we fail to equip them thus in their chosen field? English should of course be taught the four years, as has been intimated, and the present intermediate and elective courses arranged for as now.

If we agree on this point, namely, that a course similar to the present classical course—science subject in place of language subject—should be provided for our science students, what science shall replace the Latin? I feel confident that no one will question the right of physics to this high place. If Latin is the mother of languages, physics may be regarded as the father of sciences. The tendency is already in this direction. In most schools physics has scarcely less than one year; in some it has two years; and in all schools and colleges it ranks as one of the most generally taught and best equipped of the sciences. Physics applies mathematics, makes the eyes observant, trains every faculty, and forms the natural introduction to all the other sciences. If it is thus rightly taught for the four years, it should help the student to a fine perception, a correct judgment, good sense in practical affairs, and genuine culture, all of which goes to constitute the educated man or woman.

We frequently hear a girl express the idea that physics is a proper study for boys but of little use for girls. This is not correct, however, for physics is of equal value to the girl and the boy. Yet a young lady of this sort who was in one of my classes, in answer to a question on the dew-point, said that, when ice water was placed in a pitcher, the little drops of water that formed on the outside were the dew-points. She also, in answering a question how much of an iceberg will be above the water, replied that, as the specific gravity is less than one, it will all be above. Perhaps such a student is hardly likely to make a success in science, though she may do well in some other course of study. On the other hand, commend me to the young ladies for the best kept notebooks, and the neatest manipulation of apparatus. If the laws of momentum, for example, are shown to apply to the shaking of a rug, the laws of heat to the washing of dishes and to the canning of fruit, together with a thousand other practical applications, no cry of dislike is likely to arise from the female part of the class.

We are handicapped in the proper teaching of physics in a variety of ways. It is hard to find the teacher who is really well educated in this department. This difficulty, however, is becoming less, in fact all difficulties are lessening as the real value of science comes to be more and more recognized. It costs money too to equip a laboratory, yet I find that our boards of education, when they become acquainted and interested, are as ready to appropriate money for scientific purposes as for any other. It requires but a few years to equip a good working laboratory under judicious expenditure of a fair appropriation. The greatest difficulty I find in textbooks. There are plenty of them, such as they are, but some are too hard, some too easy, some are given to too much laboratory work, etc. The textbook of physics should be as the grammar of a language, as a book of reference, a book of laws and explanations. We do not ask a student in classics to work out a declension in Latin from a copy of Caesar's *Commentaries*, but from the grammar; yet some expect the student of physics to work out Boyle's law from experiments before he knows what Boyle's law is. We seem to compliment the young fellow highly by placing him thus about on a level with Boyle or Mariotte, but we do him injustice just the same. Should he not learn all he can about the law that he is expected to prove, the discoveries concerning the law since Boyle first stated it, and be familiar with the apparatus and the discrepancies he is certain to find, before he attempts to work it out for himself? That is, should he not know grammar and vocabulary before he attempts translation?

At present, little if any credit is given in college for the physics work of our secondary schools. Can we wonder at this when only a year is given to the preparation, and in that year we hurry through the subjects of mechanics, heat, light, sound, electricity and magnetism? Could not the first year be spent with profit in learning the fundamental laws, acquiring ability to measure and perform simple experiments? Could not the second year be spent in the study of mechanics, performing more experiments of greater difficulty? Could not the third year be devoted to longer, more precise experimentation, with special attention to the subjects of heat, light and sound, leaving the fourth year for more advanced work in electricity and magnetism and the manufacture of apparatus? We would thus have a foundation for any of the other science subjects, and leave the colleges free to prepare the student specially for his life work.

In drawing this paper to a close, let us review the points touched on. We find no two colleges have the same entrance requirements in physics, and no two preparatory schools are teaching it in exactly the same manner. We find science wofully neglected in both college and preparatory school, the correlation poor between them, and a lack of maturity in the results obtained. We find the classics have reached a state of uniformity that indicates a stable condition; and I make the following suggestions: That we unite in seeking proper recognition for our subjects, that we have a scientific course in science similar to the classical course in language, that physics be given the same place in such a course as Latin holds in the other, that not more than four sciences be taught in the preparatory schools, and that the colleges arrange courses to correlate with these.

Prof. H. J. Schmitz—I would like to make a few remarks. First, I would like to protest against the idea of the scientific and classical education for the high school. What is education, and how can a scientific course differ from any other if it means the development of the boy or girl for life? If the ideal thing is to fit the young people for life, it can be done in one as well as in the other. It is a mistake to talk of scientific and classical education for young pupils.

I believe that every school should have an ideal of its own. What this shall be, depends on circumstances. There may be schools in which students want a commercial education. Others which wish to prepare for college. But what are we going to do with the schools in general? The tendency is to fit pupils for higher power instead of for life. What should they demand? If a pupil has a general education, it is all that is necessary. The high school should provide this, and not aim merely to prepare for college. A course for the general benefit of mankind is what we want.

Prof. Charles F. Binns—We can regard the subject of physics as the foundation subject of every day school. And, in general, is it not a case of the "survival of the fittest"? Most of you know that it is difficult to lead any student into the higher branches of science unless he has an acquaintance with German and Latin. I know of professors who decline to take students unless they have a knowledge of Latin, this being the groundwork on which every language is based. In my own work, in clay-working, a student must understand German. It seems to me that it is no choice that Latin is selected as the leading subject in scientific education.

CHEMICAL LABORATORY NOTES

BY PROF. CHARLES M. ALLEN, PRATT INSTITUTE, BROOKLYN

Science teachers sometimes lose sight of the fact that many educators do not concede to chemistry and physics study an educational value equal to that of mathematics and language.

This educational discount is generally placed on any study which devotes a considerable amount of its time to laboratory work, which is considered with more or less justice as not demanding an adequate amount of effort by the student. The student, however, is the best judge of an easy or hard study; and I believe the average student will declare that a year's work in science, as generally conducted, stands for a decidedly less outlay of mental energy than a year in algebra or in Latin.

If this is true, I think it worth our while to seek for the cause of the unfortunate estimate placed on science study and if possible, to remove the handicap. It is, I believe, the character of the laboratory work which has brought science in our secondary schools into disrepute among many educators. If we will bring our science into good standing, we must stop "fooling with test tubes and playing with precipitates." Laboratory work should be made more strenuous than it now is. Before a student or an educator will respect a laboratory course, he must see clearly that it demands strong, honest effort. If a teacher thinks that a student works as hard in his laboratory as in his classroom, let him make the announcement, " Today you will exchange recitation for laboratory work," and note the sigh of relief, and mark the contented smile that passes over his class. These evidences of joy are not due wholly to love of laboratory work, but are caused in part by the student's escape from the harder task of the recitation hour. The prevailing lax methods of conducting laboratory work and more specially the indifferent way of recording notes of experiments, are mainly responsible for weakness in chemistry and physics study.

The textbooks of chemistry with very few exceptions may be divided as regards their experimental provender into two classes.

First, *the flabby experimental book.* This is filled with a swarm of little, easy experiments which do not demand any decent amount of mental effort by the student. I can best illustrate by a typical experiment copied verbatim from a recently printed experimental chemistry. "Take a piece of ice. Note its properties. After crushing, heat in a 100 c.cm. flask. When all is melted, note its properties. Heat the water to boiling. Does anything escape from the flask? If so, state its properties. What are the three conditions of matter?" Now what is there in such an experiment that an ordinary boy or girl does not know before he tries it? You can not make a student respect such laboratory work as that. He will rightly conclude that it is a "snap," not worth his while to perform. Yet this book is published by a very respectable firm A. D. 1900, and will doubtless be pushed into some schools.

Second, *the devitalized experimental book.* Experiments in these books are uninteresting to the student, because they inform him just what is to take place even to the minutest particular. There is a host of such books on the market. I turn at random to an experiment in a chemistry textbook which, aside from its experiments, is a most excellent book. "Prepare some starch paste and dilute five or six drops with 10 c.cm. of H_2O. Dissolve a very small piece of I in alcohol and add a drop of the alcoholic solution to the dilute starch. The starch will be colored blue. The blue color will disappear upon heating the solution and reappear upon cooling it." Such an experiment has had the life squeezed out of it by telling the student all that he should find out for himself. He can write the requisite notes just as well before he has performed the experiment, and this he will proceed to do unless watched. This verification of results predicted in the book offers nothing to compel thought, nor does it really demand anything better than careful manipulation.

There is no experimental book that is perfectly satisfactory to a teacher. Consequently, the only thing to be done is for the teacher to make his own. This can be done without undue trouble by means of printing hectographed or mimeographed sheets with experiments, selected, modified or originated by the teacher. Whether such a list of experiments may be called the teacher's own is an ethical question I will not discuss. The advantages of such a system are so many and so great that it certainly will appeal to all progressive teachers who have not yet adopted it. For this system the following advantages may be claimed.

1 A teacher may incorporate into his laboratory work at any time any first class experiment he may come across. Such experiments are constantly appearing in the new books or in chemical journals, or in such conventions as this, or, best of all, may be originated by the teacher. He may thus select those experiments adapted to his own classes and to his own laboratory facilities. Thus he has at his command an elastic series of experiments which he may cut and trim, amplify and strengthen as he will. With such a system laboratory work may be made strenuous, up to date, and worthy of a student's best effort.

2 The teacher may in a sense regard such a collection as his own. Nothing is so alive as the product made in whole or in part by oneself. There is a pride and interest in working out to success such a collection of experiments. This interest will spread from teacher to student; and the class will be vitalized with the thought that it is doing something which comes directly from the teacher's hand and is designed specially for its own use.

3 By increasing or decreasing the number of experiments, a teacher may keep his laboratory work coincident with his recitation work. I prefer generally laboratory work on most subjects to come somewhat in advance of textbook instruction. In some parts of chemistry I prefer the reverse. By this method a teacher may arrange this as he pleases.

4 There is a marked advantage in keeping the textbook entirely out of the laboratory. The average student prefers to hunt up in the book the answer to a question rather than to rely on the evidence of his own senses gained in experimental work. By using one's own laboratory direction sheet, this paralyzing tendency in qualitative experiments is corrected, and independence is enforced.

5 I have found a decided advantage in issuing to my classes a few sheets only at a time. Thus the top of the hill seems to be in sight and more energetic work results. A boy likes to report "Out of sheets". I issue not more than half a dozen at a time.

The only practical notebook, as most science teachers have discovered, consists of detachable sheets fastened in some sort of binder. It is only with such a book that a creditable record may be secured from every member of a class. With it, the carelessly written notes may be detached and rewritten, and the teacher does not commit the educational blunder of forcing a student constantly for a year to view the results of his own carelessness. This notebook with detachable sheets is adapted admirably to the system of instruction sheets here advocated. Among its advantages the following may be noted.

1 In the exhausting labor of correction of notes, at least one third of the time is occupied in collecting, handling and distributing the notebooks and turning over the leaves to find the place for correction. This time is saved when one has at hand, in a bunch, the file of detached sheets to be corrected. But what a relief it is for a teacher rolling up such a collection to be able to take it where he pleases for correction and above all to possess the blessed assurance that these notes do not necessarily have to be corrected before the next laboratory period of his class.

2 It is only by using such a system that a teacher may be absolutely sure that independent work has been done, and that he can with a clear conscience certify such notes at the end of the year. There is no need of emphasizing the crying need of honest, independent laboratory work. This kind of work can be secured only by insisting that all notes shall be written in the laboratory, during the laboratory period, and that they shall not leave the laboratory except in the teacher's hands. Such notes should be written in ink, thus saving time and at the same time teaching the student the important lesson of making his first draft his final one. When a serviceable fountain pen may be obtained for a dollar, there is no need for penciled scribblings.

The notes detached from the binder and handed in for correction, when "accepted", I think it wise to retain for a month or a half term, or till examination time calls for them for the student review study. With these precautions the teacher may surely affirm that the notes are the student's own work. These notes may not look as neat, they may not be as elaborate, but elegant handwriting and beautiful sketches are not to be compared with true, independent work.

3 With the instruction sheets for each experiment bound so as to face the "accepted" notes for that experiment, we have at the end of the course a compact and complete record of all that was required in the laboratory and all that was done by the student. This is trustworthy evidence which, because it is easily examined, is accepted by the examiner as a record of real work truly done.

As regards the form of the notebook, I have found that a simple binder opening at the end rather than along the side is preferable. A large saving of laboratory desk space is thus secured; for the instruction sheet may lie on one cover that is leaned up against the shelf, which on most laboratory desks faces the student, while the blank sheet for the record may lie flat and convenient for writing. In this way, too, at least one half of the book is kept away from "acids, bases and salts" which occasionally float over the desk top.

The size of a binder may suit the teacher's taste and convenience. I have found most practical a simple cloth-bound binder

8½ by 11 inches, opening on the 8½ inch side. This has the eyelet holes near the two corners, and the sheets are bound in by long brass McGill fasteners. This is simpler, cheaper and better than any patent fasteners. These, I have found, either tear the sheets or get loosened by use. Any bookbinder ought to furnish such a binder in cloth, quarter leather, for 25 cents or less.

The sheets of paper used are standard letter size, 10½ by 8 inches. A single sheet of this size, by using both sides, I have found large enough for recording an ordinary experiment.

I prefer unruled paper. It is neater, and students should learn to use such paper. The sheets of the record may be made attractive by bearing a printed form, providing spaces for date, number of experiment and name of student at the top. A space occupying vertically a half inch may be devoted to "Required." This includes the title and a phrase describing the object of the experiment. I have found that a space of 2½ inches is sufficient for a concise statement of "Process." For a student to condense a description of the essential things done in an experiment, and limit it to this space, is both a valuable lesson in English for a student and a relief to the examiner. Of course, if more space is needed for any experiment, it may be taken by lining out the printed word "Process," and writing it in below. The remainder of the sheet and its reverse are devoted to "Conclusions." The writing of these conclusions can be made very definite by the answering of a rather large number of questions interjected in the direction sheet. These questions are lettered consecutively, so that all must be attended to by the student. These are scattered throughout the experiment, and are designed to draw attention to its more important parts and to insure that the student understands what he is doing and why he is doing it. Thus is avoided the mechanical following of instructions which is the bane of very much laboratory work. By the independent answering of a dozen or more searching questions, most of which he can not answer till the performance of the experiment furnishes him the requisite data, and many of which are rigorous enough to start some reaction in the gray matter of his brain, we may make the laboratory work strenuous enough to win the student's respect and to demand from him some honest, intellectual effort.

The preparation of these hectographed or mimeographed notes does not occupy so much time as might be supposed. A sheet can be written from copy and a hundred prints mimeographed in three quarters of an hour. A mimeograph, provided with file surface for stylus writing, may be purchased for $22.50. From this ideal printing machine may be obtained sheets neat and thoroughly satisfactory. The hectograph may be used and is very cheap, though it is not as good. If the right kind of ink is used, and the printing is done rapidly, 200 copies may be taken with the hectograph. Here is a sample of the first and the 276th copy of a hectograph sheet, and the latter, as you see, is legible enough for practical use. These printing outfits may also be utilized for examination and other similar work.

I have no hesitation in affirming that the introduction of this system of chemical laboratory notes will be followed by a marked increase of interest on the part of the student in his work, and will do much to bring to a place of honor the work in the chemical laboratory.

Prof. E. N. Pattee—I agree with the paper of Prof. Allen, that the weak point in chemistry is in the laboratory work. Textbook work is well done, but the emphasis should not be placed there. I have yet to find a student who thinks that the work done in the laboratory is as effective as that done in recitation. If science teachers are to be recognized, we must have as good work done as is done in algebra, mathematics, geology, etc. Prof. Allen has not overestimated the importance of strenuous laboratory work.

Prof. Burchell—I appreciate the work of Prof. Allen. There is a question I want to ask. About 15 years ago, when my work was shorthand, I began a system similar to his; but, when I began to take up this work of science, I was reluctant to use as my own that which belonged to other textbooks. I want to ask how the authors feel toward those people who follow this plan of making up laboratory manuals of their own? What are our privileges and limitations in selecting that which we think is best from other sources? Is any injustice done to the people whose textbooks we use so freely?

Prof. Allen—I think, if we examine a list of 20 books, that we will find that four out of five of the experiments are common to all chemistry manuals. No fault is found in these cases, and the writers of the books are not infringed on in any way. No law is violated nor any copyright. We must remember that the material is not selected for publication, but simply for class use. If desired, it may be quoted with proper mention of the source.

HOW TO MEET THE PROBLEM OF TEACHING PHYSICS BY THE LABORATORY METHOD IN SECONDARY SCHOOLS.

BY FRANK M. GILLEY, CHELSEA (MASS.) HIGH SCHOOL

Headmasters and others who have to do with the administration of secondary schools are beginning to question more and more seriously the necessity of special provision in time and division of classes for laboratory courses in physics. "Why," they ask, "should not a class in physics be of the same size and subject to the same hours as one in English or mathematics?" In some cases the questioning has developed into more or less active opposition to extended courses in science for which such special provision is demanded in the way of hours for study and recitation. The demand for smaller classes also has gone far to place science on a plane different from, and lower than, those occupied by other studies in the estimation of various school authorities.

When, however, such authorities proposed to put physics on the same basis as algebra and Greek as far as time allowance is concerned, teachers called the plan at once an absurdity. "With 24 or more in a section," they say, "a 40 minute period would allow us less than two minutes to each pupil." This comment touches at once the difference between the algebra class and the physics class. The algebra class is taught more or less as a whole, while the physics teacher looks at once to the amount of individual instruction he can give to each pupil. If the physics class could be taught as a whole, then, it might at once be put on the same allowance of time in the curriculum as the other studies. Many teachers will be inclined to say offhand that it can not be taught as a whole because the pupils will not "keep together." But why should they not be forcibly held together as firmly as are pupils in Latin? That a pupil could perform the work of an ordinary laboratory exercise in the same time he occupies in his Virgil or Caesar class, few teachers would be disposed to deny. The problem is to get the entire class to grasp the exercise, set up the apparatus, and perform their work without waste of time. Experience has shown that study by the pupil of his textbook or laboratory manual before coming to the class is but slight help to that end. Neither does it always serve to have the teacher explain the construction and working of the apparatus beforehand. The only effective way of accomplishing a short hour laboratory exercise is for the teacher to indicate or perform each step of the work, and let each pupil follow him, performing each step according to directions. At first glance this may seem merely formal and a pure waste of time; the truth is, however, that it saves completely all the preliminary helpless handling of the apparatus which two thirds of the class always go through when left to a set of printed directions, a process over which enough time is often wasted to perform an entire exercise.

The teacher should begin by giving directions for the form of record, including name and date if desired, giving special care to the description of apparatus. For the last he should make a diagram on the blackboard and exhibit the apparatus itself, or perhaps an enlarged model. He should then give the directions for the experiment, whenever possible holding the apparatus up before the class and performing each operation as he describes. If the experiment is, for instance, "images in a plane mirror at an angle of ——", he will begin his directions for the exercise proper with some such directions as these: "Lay a sheet of paper with one corner at the center of a page of the notebook in this way. Set the two mirrors along the edges of the paper, so that they meet at the corner in the center of the page. Look in the mirrors. Hold a pencil between them. Count the images that you see. Cover one mirror with a sheet of paper. How many images disappear?" At this, or at any convenient point, directions may be given to write down the method of the experiment as far as performed, together with the observations taken. The teacher meanwhile may go about among the pupils, looking at their work enough to detect any prevalent mistakes or omissions. My own experience has been in this particular exercise that half the class will at some stage of the work have their mirrors more or less off the lines. If at the beginning I notice one who has made this mistake, I say to him without calling him by name, and loud enough for the entire class to hear, "Are your mirrors on the lines?" If the rest of the class do not at once correct the mistake, call the attention of the entire class to the error and give directions for its correction. By this method most of the mistakes to which a laboratory class is liable may be corrected with little or no individual attention to the pupils.

The directions for the exercise might then continue somewhat as follows: "Draw lines in the books along the edges of the sheet of paper. Remove the paper. What is the angle at the corner? Replace the mirrors. Complete the title at the head of the exercise to read at an angle of 90°." At this point the teacher may find it best to go about the class and draw an arrow in each notebook between the mirrors. If the parallax method is to be used, the directions would continue: "Place a pin at the head of the arrow and letter the point A. Letter the right-band mirror M. Locate the position of the image you see in it by placing a long pin behind the mirror in such a position that the image of the long pin seems to be a continuation of the image of the short pin. Move the head sideways. Do the image and the long pin keep in line? If not, try the long pin nearer the mirror or farther away from it." Of course the pupil is not to be reminded of the fact that the large pin must be as far behind the mirror as the short pin is in front of it, but the suggestion, "Try it a little nearer" or "a little farther" to a pupil who is in error is perfectly permissible. As a teacher goes about the class, his eye, moving past the desks in succession, will detect at a glance the one who must try again.

"Make a circle round the point of the large pin," the directions continue. "What does it mark the position of? Letter it A." Perhaps beyond this point the questions need not be quite so minute, but this the teacher may determine from the character of his class. Opportunity should be taken now to inspect the work, praise it whenever possible, and assist those who always need assistance. The very rapid pupil, or perhaps one who is trying to "show off," will very likely have made some error and have to go over his work again. In most cases it is better that he should waste his time than that he should call the teacher away from the class to answer his conundrums. If time remains, dictate problems, some to be handed in at once, some to be done outside the class. Let those who finish the exercise first, study the diagram in the notebook and find some rule by which the third image can be located. Ask, for instance, how far it is behind the righthand mirror. How far behind the lefthand mirror. What happens to the third image when the angle between the mirrors is decreased. Suggest a way of setting mirrors at right angles. Draw lines at right angles and locate the third image of a point between them.

It is easy to continue along these lines with experiments that will be found useful as supplementary or review work on this exercise. Let the pupils fold a sheet of paper making the crease from the corner for an angle of 60°, and setting the mirrors by it at that angle, and count the images in them of an object placed between them. Let the rapid workers experiment with angles of 45°, 30°, 22½°. Arrange the results in some such tabular form as:

Number of images	Angle between mirrors	$\frac{360^\circ}{\text{angle}}$	Number of images + 1

In the case of very young pupils, if the work outlined is divided into two or more exercises, in one of the cases described, set between the mirrors a card a centimeter high, marked on one side. Then all the images of the mark will be reflected first from the mirror facing the mark. By these methods that I have been outlining, it becomes a simple matter for the teacher to establish at the beginning whatever connection there may exist between the exercise he is taking up and the exercise that preceded it. If the exercise following the one just described is on parallel mirrors, let the class begin by decreasing the angle between the mirrors from 45°, five degrees at a time, and reporting the effect on the number of images. Finally, setting the mirrors parallel, let them locate by parallax method a few images in each mirror, and try to find a rule for their positions.

The first objection that will be urged against this method for laboratory classes is that it is mechanical. In theory it may appear so; but one has only to try it to find in every exercise a point is reached before the end of the hour when the pupils may be left to finish the exercise by themselves, and often they will have time left to repeat it, or try some variation. Often too there is time left for a short explanation or experiment by the teacher, or problems and oral questions—and problems dictated at this time to be done outside of the class are often a valuable reminder to the pupil that there is another lesson coming. The teacher working along these lines is left free, instead of being at the call of every upraised hand, to pass around the class and see for himself whether the directions are being obeyed or not, and give directions for the remedy of any prevalent mistakes. He may do particularly effective work in criticizing the form of record. Such a criticism made without calling the pupil by name will usually take effect on half the class.

It is better to give 80% of your pupils an hour's instruction than to give 100% of them one minute. The choice is between the method we have been describing, that of one teacher one class, or the more common method of one teacher and one pupil; for, no matter how small the class, the individual method leaves out all but one. The method of having all the class at work at once, each on a different experiment, is the worst of all. It saves apparatus to be sure, but it wears out the teacher, who can not handle his class as a whole on any point whatever during the hour.

In more complicated exercises the method I have been describing will be found equally effective. Let us apply it, for instance, to the Wheatstone bridge experiment. Suppose the class already acquainted with experiments on the fall of pressure along a pipe carrying water, and the flow of water from a point of high to a point of low pressure. Suppose them, too, to be familiar with the fall of electric pressure along a wire carrying a current, and with the fact that this fall of pressure increases as the resistance increases. When they are supplied with the usual apparatus, and a one ohm wire or coil, and a wire the resistance of which is to be measured, give them directions step by step, for connecting the battery, galvanoscope, and the known and unknown resistances. After each step is indicated, lines and letters should be added to the conventional lozenge-shaped diagram of the bridge, and to another diagram showing the form of bridge actually used. It is well to have the unknown resistance a little more or less than an ohm, so that the slider is near the center of the bridge when the galvanoscope shows no current. Tell the class to move the slider within 20 cm. or so of the righthand end of the bridge-wire, and ask them which way the N end of the galvanoscope pointer turns. Then let them move the slider to the other end of the wire, and then try to find the point that is at the same potential as the junction of the known and the unknown resistances. When this point is found, let them record the position of the slider. Now take the data of some one pupil and work out the unknown resistance on the blackboard, and the pupils can at once do the same with their own data.

Up to this point the class has worked together as a unit. Now let each go his own pace. To keep them profitably busy, use a two, five, or a one half ohm wire as the known resistance, and let them find whether the computed results for the unknown resistance agree. Let them find the resistance of a cell, a battery carbon, a miniature incandescent lamp (cold), a telegraph sounder, a telephone receiver, a transmitter, the primary and secondary coils of an induction coil, a commercial transformer, an electromagnet, coils of galvanoscope and galvanometer, ammeter, voltmeter, a dynamo armature and field, a thread of mercury in a tube (old standard ohm). If all this is not enough to keep an eager pupil busy, try interchanging the battery and galvanometer. Other exercises might take up specific resistance, and the effect of temperature on resistance. It is only necessary to get the class as a whole started on the right track, so there will be no need of telling each pupil separately anything that can be told to the class as a whole. Before long a class that has been taught by this method can safely be left to itself in the performance of exercises described in the textbook as the training they have had in following instructions dictated to them step by step will serve them well in following printed instructions. Indeed, the necessity for instruction varies greatly with the nature of the subject, and the same is true of laboratory work itself. The management of classes in physics would be greatly facilitated if the fixed divisions of the time into lecture, recitation, and laboratory work could be done away with. In such a subject as light, laboratory work should occupy a large part of the students' time, while the laws of motion may be studied with scarcely any.

While these matters I have brought up, I have meant to apply chiefly to large schools, still, where the classes are 10 or less, the method of instruction may be modified in the case of a few exercises in which it is possible to make one or two pieces of apparatus suffice for the whole class. In such cases the class may gather around a good-sized table, and one pupil after another perform the essential parts of the experiment. The apparatus should be assembled and taken apart several times, and the pupils should both do it and see it done. Each pupil may take his own readings. Suppose that, in testing a thermometer, only one steam boiler is available. This should be steamed up while each pupil is taking the melting point of ice. Then the thermometer should be warmed in the hand or mouth (perhaps incidentally taking the temperature of the body), and put into the steam dome of the boiler. While waiting for their turn, pupils may read the barometer, figure what the true boiling point should be and make a diagram and description of the apparatus. One composition of force board will keep a class of 10 busy, the dynamometers or spring balances being held in position by clamps. After all have made readings and diagrams of the apparatus, some changes may be made in the forces and their points of application, and a new case recorded.

If we are to give physics its place as the chief and fundamental science study in large schools, there are needed, in addition to the reforms we have been discussing, convenient laboratories, suitable apparatus and trained teachers, who are allowed time both in and out of school for preparation. Assuming that there has been allotted to the physics teacher sufficient laboratory space (and this is far greater than is generally provided by the architect), the next problem is to obtain good working apparatus, one piece per pupil for each experiment. As an appropriation sufficient to provide apparatus for the entire list of exercises in the course is seldom made at one time, it is generally best to use the money as far as it will go in procuring enough apparatus for a few exercises and teach by the laboratory method as far as the apparatus will allow. Since some of the simpler apparatus may well be made by the teacher, a part of the appropriation should be spent for tools and raw material. The cost of stock for a set of apparatus for 25 quantitative and several qualitative experiments covering the subject of light is less than $1 a pupil. And this estimate includes a few things, lenses, prisms, etc., which the teacher would not dream of making. The lack of equipment should not stand in the way of an *introduction* of the laboratory method of teaching physics. In asking for an appropriation, the argument might be made that a city or town that can afford to employ a science teacher can not afford to fail to supply that teacher with tools of his trade.

However small the annual appropriation, a constant attempt must be made to increase the equipment, and in certain portions it should be complete, with apparatus for the individual pupil. Whatever is the size of the school, there should be an appropriation for physics just as surely as the seasons come round. It is not the best course to spend this all in one lump sum. Several times a year the way should be open to buy supplies as they are needed. Is there a large business anywhere in which the year's supply is contracted for and purchased at one time? Some department of the national government perhaps. You all know what is the effect there on the cost of production and the time of completion.

The class laboratory method, then, requires a complete equipment for any exercise attempted, spare periods during school sessions for preparation, freedom from petty responsibilities before and after school and a laboratory assistant. The setting up, clearing away, preparation and repair of apparatus, and, during an exercise, the distribution of materials, much of the cleaning of the laboratory, arranging for lecture demonstrations, and correcting exercises can be done as well by an assistant costing from a half to a tenth the salary of the teacher, who is left free for more and better work. If much of the routine work of the laboratory is drudgery, is it profitable to employ a $1000 or $2000 drudge? To test and put in order the apparatus for the slide wire exercise as I have described it, to prepare the known and unknown resistances, several hours are required of work that an inexperienced assistant can do after working a few minutes with the teacher. The teacher should be employed to teach and do such work as can not be done by assistants. The colleges have for years made profitable use of laboratory assistants. Many a teacher drawing a salary of $2000 to $3000 occupies half or more than half his time in doing what could be better done by a $300 assistant. Is it strange that physics teachers have so little time to study?

The teacher must know his subject. He must read the scientific and mechanical journals, glance through the magazines in search of popular presentations of new discoveries, ever striving to get a broad glimpse of the field traversed by the progress of science. He can not however study experimentally the fundamental principles of physics, and obtain firsthand means for illustrating his talks and lectures unless he has acquired some skill in the use of tools. Newton made his own apparatus. Faraday wound and insulated his wire. That, to be sure, would be poor economy today, but there are other things as useful as insulated wire that you must prepare yourself. The simplest portions, and by that I mean the very simplest of the tinsmith's, gasfitter's, blacksmith's, machinist's, carpenter's, glass-blower's and manufacturing optician's trades are all useful. How much more real are lenses to you and your classes if you have one you have ground and polished! How simple the principle of the thermometer becomes, if you blow and finish a crude model before their eyes! You will find after you have acquired some mechanical skill, that the apparatus always works, and timeworn apologies for failure are things of the past. A broken galvanometer suspension means 10 to 30 minutes time at the bench to make good, in place of several hours of correspondence, and days of waiting for the apparatus to be sent to a distance and the damage repaired.

In closing, let me remind you that in demanding adequate equipment and time on the program for physics, you should call attention to the fact that home work can be assigned after the first lesson, much of it of a kind, problems, questions, diagrams, plotting, etc., that is definite and is easily corrected; and the pupil's application to his work and his progress can be tested from the very start.

Further, you are demanding a place for a study that should be preliminary to all other sciences. Without a ready knowledge of physics, meteorology is little more than a landsman's guess of the weather, astronomy a popular and meaningless description of planets and stars, and chemistry is unnecessarily difficult and in portions unintelligible.

Prof. Osborn, of Olivet College, quotes the leading physicist of this country as saying that, to train his powers of observation and classification, let the student study natural history; to give care in experimenting and convince the student that nature forgives no errors, let him enter the chemical laboratory; to train him in exact and logical reasoning, let him study mathematics; but, to combine all this training in one, let him study physics.

Section B. BIOLOGY

IDEALS IN TEACHING

BY PROF. ALBRO D. MORRILL, HAMILTON COLLEGE

[*Abstract*]

Among the ideals which have dominated students of natural history, at different times, only three need our attention, on account of their prominence in modern teaching of the natural sciences. The first is classification, or taxonomy, an important branch of knowledge; but, when it absorbs the whole attention, as it did less than 20 years ago, in our schools, it gives but meager results, as some of us know by experience.

The plan of mounting and labeling plants and animals was later largely replaced by the study of types or examples. This change was greatly aided in this country by Huxley and Martin's *Elements of Biology*, since followed by scores of other works. This led to a more thorough understanding of the structure of plants and animals, also of their relationships, than the examination of the external form with a view to classifying them. This study of types has been associated in teaching with evolution, though historically the latter is much the younger. In the study of evolution, variations in domestic and wild forms of animal and plant life and their adaptation to changed or changing environment and struggle for existence divided the field with embryology, where, working on the basis of von Baer's law, the attempt was made to reconstruct the ancestral types of the different groups of plants and animals. Today we may find these ideals, together with the physiologic one, separately or combined with each other in ecology.

Much might be said in favor of emphasizing the physiologic ideal, as plants and animals must be studied as living organisms to gain a full understanding of the many problems involved in classification and morphology.

As we always have the poor with us and often without any fault of theirs, so we have teachers of science whose highest ideal, in practice at least, is to get as many pupils through the examinations as possible, and to whom the teaching of old examination papers takes the place of something better. I said it is not always the teachers' fault, for they are often given insufficient time or equipment, and real science is not a subject to be swallowed whole and disgorged in chunks in an examination. Then there are cases where the school authorities, teacher or pupils, or all, may be unable to see any use in a subject which is not immediately useful and capable of being coined into dollars.

There are, unfortunately, among the university-trained men who are teaching in high schools or colleges, too large a number who consider the work of teaching a bore and who devote their time to their own researches. It is not intended to decry research, as it is of the greatest importance, but too great a devotion to it.

In elementary work, at least, the pupil is of much more importance than the subject; but there are those who are more disturbed if they can not present the subject symmetrically than they would be to know that they were developing in their pupils a positive hatred of the subject and the worst methods of study.

There are two principal methods of conducting laboratory work and many variations. In one, lectures and demonstrations precede the work of the student, and the time in the laboratory is devoted to the verification of the outlines furnished or of reference books consulted. In the other observation by the pupil, aided by brief and simple questions, is made the preparation for consulting reference books under the guidance of a careful instructor, who aims to help the pupil to help himself rather than to tell him that which he can see with his own eyes. This is followed by a class conference, where comparisons are made and notes taken to help in looking up the disputed points. Then the instructor can, by demonstrations and explanations, supplement the work of the pupil. Thus the pupil, with a nucleus of his own carefully sifted observations and with the interest generally aroused, attracts facts as a magnet does iron filings. The latter method requires however an experienced teacher to prevent discouragement and to develop the pupil's self-reliance.

The pupil who takes up a science for the first time after reaching the age of 15 to 19, as we often find the student doing in college, has in too many cases been taught to be the passive recipient of the ideas of the book or instructor. The book is to him a fetish. Many of us have undoubtedly seen some of these devotees searching (surreptitiously) for drawings or descriptions in some reference work and sometimes handing in pictures of an animal of a different species from the one which they were supposed to study.

The extreme method used by Agassiz in his training of investigators has unquestioned advantages in killing off weaklings, but is of little value in an unmodified condition for younger pupils. The pupil needs judicious guiding rather than driving or being left to his own resources. The teacher should be a lover of nature and devoted to truth for truth's sake; at the same time, he must not be too exacting of the beginner. As the work advances, more and more must be expected of the pupil; better description and more accurate drawings. One of Agassiz's mottos, "Study specimens and refer to books," gives in a nutshell one of the great principles of zoologic study.

It is a pleasure to watch each pupil for some glimpse of real interest and to make it easy for him to take a second and many succeeding steps toward independent work. Develop his individuality whenever possible. The laboratory and its appliances, together with the instructor, should be simply aids to individual development.

The influence of a single enthusiastic student in a class, who has good methods of work, is many times more powerful than that of the instructor. The more good workers in a class the harder it is for the indifferent to remain uninfluenced. The advantages of summer schools for the best student in a class of college students can hardly be overestimated, as during the succeeding year they are able to stimulate their associates by the better work and broader views which they bring back with them.

In the time usually allowed for zoology but few types can be studied; but the more or less superficial examination of many related forms and anatomic preparations as soon as the study of each type is completed will prevent the narrowness too often associated with the study of types alone.

Whenever possible, a living representative of each group, if not the animal dissected, should be examined; and for this purpose simple aquariums and vivariums are becoming more necessary.

In a few places salt-water aquariums are successfully maintained with the advantage that the habits can be studied by the beginners, and material for research kept constantly on hand.

There are differences of opinion as to whether the elementary work in biology should be the broad and somewhat superficial examination of many forms before the minute and rigorous study of the few or the methods should be exacting from the start.

The .tendency, as you well know, is toward the so called natural history method, with less use of scalpel and microscope in the high schools. In all work personal observation takes the first place, followed closely by comparison and experiment. The spirit of investigation, with its judicial consideration of all the facts, should not be ignored, but, whenever and wherever possible, cultivated to the fullest extent.

Should we attempt to train botanists, zoologists, or physiologists? If so, we can but fail in most of the cases. If we are able to strengthen the enthusiasm, help to form correct methods of working and develop fair-mindedness, the few who go on to advanced work will be able to choose, each for himself, the particular field of work. There are dangers, on both sides, in too little and too much help for the learner. There should be no sharp transition from learning to investigating, be it in science or in life.

Prof. H. R. Linville—I am much impressed by one point of Prof. Morrill's, that is, the mistake of giving laboratory work wholly into the charge of assistants. The instructor who gives the course should also have control of the laboratory work and of the assistants.

Prof. A. J. Grout—May I ask whom Prof. Morrill means by assistant?

Prof. A. D. Morrill—A graduate assistant is what I meant. I have such an assistant that does all the work that can be given to him. He is there most of the time, and it works very successfully. I have studied his methods, and am satisfied with his results in botany.

Prof. N. A. Harvey—One thought came to me as Prof. Morrill was speaking about the changing ideals in science teaching. Perhaps I would better illustrate it by carrying the matter of ideals into what I have seen applied in recent years. The time the reports of the X-rays experiments were being applied, college graduates, high school teachers, normal school teachers were all teaching X-ray experiments. And then wireless telegraphy became the fashion, and college graduates, normal teachers, and high school teachers devoted their time to that branch of science. At the southern end of Lake Michigan are pronounced specimens of sand dunes. Scientific men began to study them; then high school teachers knew about them; then the teachers in the high schools, normal schools and elementary grades began teaching sand dunes. All schools began studying sand dunes. They occupy a large part of the work in geography. It may be the proper thing to do; but I question whether that is the best ideal to set up and make the basis of the study of geography. Somebody in the Chicago University made special study of the Chicago plain; but since then, the university teachers, high school teachers and normal teachers are all studying the Chicago plain. I doubt much whether this ideal we set up is the best thing to do, and that everything we have done before should be discarded and the new thing taken up. Dr Cowles published an excellent paper in the *Chicago Magazine* on plant societies. Teachers are studying plant societies; universities, high schools and normal schools are studying plant societies. Whether the thing is eminently proper and should be taken up and made so much of, and whether the things we have been doing previously should be so discarded, I will not undertake to say. It seems to me that we have excellent opportunities to use common sense. Science means common sense.

Prof. C. W. Hargitt—I want to say a word regarding one point, namely, the importance of a unified and harmonized outlook in the work of science teaching in college and schools. The paper called attention to the fact that sometimes the departments become differentiated, and perhaps lose their common point of view: the department in botany perhaps, or in zoology, or in physiology, where, exercising his interest in research along one special line, and ignoring nearly every other part of the biologic work, the teacher may make an unwise distinction. I believe that both for the college and the high school, the idea from the point of view of general biology is a very valuable one, and one which we ought not to discard. And the teacher can be trained with the ideal that there are fundamental results to be obtained, and that his teaching may not lose sight of that principle. We can get more harmonious work than if we start out with the idea that physiology is the only thing in biology; that botany is the only thing in biology, etc.

Now it seems to me that the point raised by Prof. Harvey is not a very serious matter, providing there is a broad foundation back of it, i. e., that there is more in physical geography than "sand hills;" that there is more in geology than the "Chicago plain." I suspect that one of the troubles is that there is lack of proper balance. That is a tendency in these days. However, when we are brought face to face with the sand hills, here is something concrete and directly at our hand. We don't have to travel to study. The fault in the past in such work is that teachers have been led away into Europe, the Adirondacks, the Rockies to get illustrations; and, when the college professor brings them face to face with these things at their own door, they have lost sight of the balance—the relation these things sustain to the entire realm of nature. The danger is not in taking lessons from things at hand, but in not having a foundation back of them that will put them in their appropriate relations. The fault is not in the system, but in its proper adjustment and application.

Prof. F. E. Lloyd—It appears to me that educational fads are not altogether to be deplored. In following a fad for a time, we may at least believe that a teacher gets many new ideas, becomes acquainted with new points of view, and with new lines of thought. A teacher who may be accused of following a fad may not at any rate be accused of being asleep; and on the whole he is better off for the stimulus. We may have no doubt that the pendulum will swing back again, leaving little or no harm done, and, not improbably, considerable good.

Prof. Morrill—We can help the teachers in high school by suggestions. Suggest changing, and at one time giving wireless telegraphy, and at another time something else. The board may be very anxious that pupils shall understand wireless telegraphy. In that case I should use every effort to persuade the board to let me have more time, and use it for other purposes, and more than that get more money out of them for what I considered the real thing.

Prof. E. B. Callahan—The reason why teachers are so liable to copy the work done by advanced teachers is that they have had poor preparation. As you know, laboratory work in the sciences is a new thing. I think you will find that the teachers of the high school are giving you the highest kind of praise when they copy you; and they follow the investigation of the sand hills because they think it is the best thing to do. The teacher who has a good preparation before he gets into the high school can see the relation very well and is not so liable to copy.

THE TRAINING OF A SCIENCE TEACHER FOR SECONDARY SCHOOLS

BY PROF. N. A. HARVEY, CHICAGO (ILL.) NORMAL SCHOOL

It is easy to say what a teacher should be. He should have all of the virtues and none of the vices of the greatest men. The dignity of Washington, the generalship of Napoleon, the wisdom of Franklin, the statesmanship of Webster, the sympathy of Lincoln, the eloquence of Phillips, the scholarship of Gladstone, the business ability of Morgan, all of these things enter into the make-up of the ideal teacher. But, when a man is found who possesses any small proportion of them, he becomes unavailable for teaching at $60 a month, and is made president of an insurance company, or railroad, or a trust. So our teachers are not and will never be ideal teachers.

In a high school the teachers must be the very best that are available. I feel sure, notwithstanding the prevalent opinion to the contrary, that the high school period is the period of the greatest influence in the life of a pupil. It is a more important period than the period of elementary education, for it is at this time that the outlook of the pupil on life becomes enlarged beyond his immediate surroundings, and he begins to plan for his life work and to adopt life policies.

A teacher of science in a high school ought to know three things: first, his subject-matter; second, the psychologic movements involved in learning the subject; third, the principles and the art of teaching.

No one questions the necessity of knowing the subject. No one admires the fulness and clearness of information that some teachers possess more than I do, though I think there is a tendency at the present time to lay so much emphasis on it that we are inclined to exclude other things of equal importance. Other things being equal, the greater amount of knowledge that a teacher possesses, the better he will teach. It is an evident impossibility for a teacher to know the details of his subject throughout its whole extent, but he must have such a knowledge of it as to furnish a background for the particular phases of it that constitute the material for class study. His knowledge must be much more extensive than he expects his pupils to have after they have finished their work with him. There is no better way of learning a subject than by teaching it, and every teacher must be in the attitude of a learner as long as he teaches. I would suggest a possible error, though there may never be any occasion for the caution I present. I question the wisdom of a teacher carrying on a line of study that is foreign to the work of his class, or that is only remotely connected with it. There is always so much connected with the subject that the class is studying that the teacher does not know that there is abundant opportunity for the exercise of all his powers, and his study is then directly beneficial to his class. So I should not expect a teacher to know every fact in the whole range of experience before beginning to teach. A part of his energy would better be devoted to something else. The teacher of botany must be something more than a mere botanist. He must be a teacher, and he must be a man.

We have heard much in recent years of the necessity for the teacher's being an investigator. The justification for this opinion is the belief that research work has a greater educational effect on the mind of a student than the ordinary acquisition of knowledge. It can not rest on the assumption that there is not already sufficient knowledge in the possession of the world to furnish material for teaching, nor that the teacher has already learned all that is known in the whole domain of science.

I believe as strongly as anyone in the value of research work. I would have every exercise an exercise in research or productive of the same kind of value. This is easily possible if the teacher keeps textbooks, reference books and lectures out of the way of the class till they have had an opportunity to exercise their powers of investigation on the problems that the teacher sets before them. Where a teacher lectures to his class about the subject yet to be investigated in the laboratory, or assigns lessons from a book before laboratory work on the same subject is undertaken, none of the value of original investigation is possible. But I find this plan recommended in some books of high reputation.

On the other hand, some teachers in high schools are so imbued with the spirit of research that they set their high school students to work on research problems, believing that thus they are conforming to the most progressive ideas of education. To students of this age, with no more training in methods than they have had and no more knowledge of what others have done and said in similar lines than they possess, the conditions are identical with that of a class under the instruction of a teacher who is wholly ignorant of the subject of instruction.

The difference in the two cases is simply this. In the first case, the teacher knows what the pupil is trying to do, what result he expects him to get, why he wishes the pupil to do the work, and the place in the scheme of instruction that the work occupies. The pupil is kept from doing useless things; wasted energy and positive mistakes are avoided.

For three successive years I taught two classes in physics. One was a class of high school graduates who had studied physics with textbooks in hand and in laboratories of various degrees of efficiency. The other class had never studied physics. The two classes were nearly of the same size, same age, used the same laboratory, same guides, had the same teacher, same apparatus, same exercises. In about seven cases out of 10 the class that had never before studied physics obtained a result that was more nearly accurate than was the result obtained by the high school graduates. The recurrence of this phenomenon for three successive years, under circumstances so peculiarly favorable for comparison, seems to justify the statement that the effect of textbook study in connection with a laboratory is to diminish the ability of pupils to obtain accurate data for use in the derivation of laws. I feel sure that textbook 'study in biology will have a similar effect, though the proof of the proposition will be more difficult to obtain.

This discussion has somewhat encroached on the discussion of the other elements in the preparation of the teacher, for I believe that no one who has made a careful study of the content of the subject and the principles of teaching will be led astray to the degree that I have indicated. At least it seems to me that we have in the above discussion an example of the necessity for the preparation of a teacher in other things than subject-matter.

Within certain limits, all minds act alike. They have generic characteristics in common. There are general laws of mental action that lie at the basis of all our attempts at education. Education would be impossible if it were not for this common basis of thought. A teacher, whose business it is to incite the mind to act and to employ its self-activity, must from the nature of the case know what are the laws of mental action and growth. It is not enough to know in a mere theoretic way what psychologists have formulated concerning the operations of the mind. It is necessary to know how to bring the mind of the child into the presence of the subject-matter in such a way that its activity shall be aroused, and growth result.

This is the thing which makes the difference between the teacher and the mere scholar; between the artist and the artisan in school work; between the one who looks at the logical development of the subject and the one who sees the psychologic movement of the learner; between the one who teaches the subject and the one who teaches the child; between the one who gets his methods from a book and the one whose method is determined by the mental movement involved in education. The day has gone by when it is possible to maintain that knowledge of the subject is sufficient preparation for teaching it. There is just as much necessity for the application of pedagogic principles in the high school as there is in the elementary school.

Granting that good teachers do not just happen, we must allow that there is necessity for preparation. There are several ways in which preparation may be made. There are normal schools whose sole aim is to prepare teachers for their work, and they seem to be justifying their existence. As a strictly professional school, the normal school, from its very nature, takes precedence of all other kinds of schools for the preparation of teachers. The thing that a normal school undertakes to do is as necessary for the training of a high school teacher as it is for the training of a grade teacher.

It is commonly believed that the limitations of normal schools render them incapable of training teachers for the high schools, and that they should limit their efforts to the preparation of grade teachers. There is some justification for this opinion. In my own experience as a teacher of science in a normal school, I am unable to call to mind three teachers whom I could conscientiously recommend as teachers of science in a first class high school. It is true that many of my former pupils are teaching very successfully in high schools, but they owe little to the normal school for preparation in their special work. This condition is not inherent in the constitution of a normal school. The great demand on normal schools for the training of grade teachers and the relatively small number of teachers in any one subject demanded by high schools have rendered it inadvisable for normal schools to lay emphasis on the high school work. I think it will be admitted by everyone that, as at present organized, normal schools do not give sufficient preparation for the teachers of science in high schools.

The next thing is to seek for teachers that have been trained in colleges and universities. This does not constitute an ideal preparation for the teaching of science. The college-trained teacher has some very serious limitations. In the first place, he is likely to be so wrapped up in the matter of his subject that he teaches the subject rather than the pupils. He is unconscious of the fact that teaching is anything except the imparting of knowledge. His teaching is likely to partake of the nature of the pouring-in process. He looks at the subject from the standpoint of adult logic instead of child psychology. His methods are likely to be copied without serious attempt at adaptation from the teachers in college; and in many cases these are known to be very poor models to copy from. In fact, in the absence of knowledge of the principles of pedagogy, it is a serious question if the great amount of detailed knowledge of subject-matter that he is popularly supposed to possess, and which is generally regarded as the one redeeming quality of a college-trained teacher, is not a positive disadvantage instead of a help. Comparing the college-trained teacher with a normal-trained teacher, it is a choice between two evils. Given one of the smaller high schools, in which one or two teachers do most of the teaching, and each teacher teaches seven or eight different subjects in a day (and this represents the greater number of high schools in the country) and I think the normal-trained teacher has proved himself decidedly superior. Where the school is of such a nature that the teaching of one person can be confined to a single subject, the limitations of a college-trained teacher are not so apparent. But so serious are they that I have been reliably informed by high school principals of much experience, that they expect, as an ordinary thing, the first two years' teaching of a college-trained teacher to be a failure. I suspect that every teacher who looks back at his first two years' work and who has attained a recognized proficiency in teaching, will be willing to acknowledge that two years are a low estimate.

It is true that the last few years have shown a rapid increase in the number of college-trained teachers that have been brought into the high schools. Observation of the fact in four states has indicated to me that this has not been from a spontaneous recognition on the part of school boards or school principals of the superiority of college-trained teachers, but has been brought about by a kind of influence on the part of universities of scarcely a legitimate kind, in refusing to place high schools on an accredited list unless they were provided with college-trained teachers.

There are three alternatives, or perhaps I ought to say four, by which better trained teachers may be secured. Two are at present available, and two need a modification of agencies already existing. First, normal schools may modify their constitutions in order to meet the demands for high school work. The plan at present under consideration for the Chicago Normal School is that the present two years' course shall be distributed over three years and shall be required of high school teachers just as it is now of candidates for the elementary schools; but in this distribution, there is an opportunity for the candidate to carry on a special line of work two hours a day for two years in the subject he may wish to teach in the high school. If that is biology, for example, there may be a proper division of this time among the following groups of subjects: technic, including the theory and practice of microscopy, microtomy, photography and projection; second, systematic botany, morphology, physiology and ecology; third, systematic zoology, morphology, embryology and osteology. The methods may include laboratory work, textbooks, lectures, readings, recitations, with special attention to the subjects that constitute an ideal high school course, and the psychologic movement involved in scientific teaching. It is not likely that this plan will be adopted. The additional equipment and expense would not be very great, but the number of teachers of biology demanded by the needs of the Chicago high schools is so small that it would be scarcely worth the effort.

The second plan is that universities shall so modify their courses in pedagogy that there shall not be the absolute divorce which now exists between the theory of education and the practice of teaching. So far, the pedagogic courses of universities have not seemed able to hold their own with the vigorous aggressiveness of the other subjects. There has been quite general lack of appreciation of the pedagogic courses by other departments, that has exercised anything but a benign influence on the teaching of university students.

Third, the teacher may get his knowledge of his special subject in the university or college, and his pedagogic training in the normal school. The normal school is a professional school, standing in this respect with the schools of medicine and law. We should expect that the best results would be obtained by giving the university training first, followed by the normal school work. In practice it is found that the reverse order works better. It makes a great difference in the teaching of a subject whether it is learned in the light of great educational principles, or whether it is viewed from a different standpoint. Students who are well grounded in the principles of teaching are able to see what is involved in particular methods, and are able to criticize intelligently the materials and methods offered in universities. On this account, I am reliably informed that normal school graduates are not always considered the most desirable students in universities.

It seems to me that the last is the most advantageous plan for securing better trained teachers for the high schools. In Wisconsin there is an arrangement by which normal school graduates may enter the state university in the junior year, thus being put at no disadvantage with students who go directly to the university from the high school. If this policy were made general, I think the matter of teachers for the high schools would be quite satisfactorily adjusted. Scarcely any other arrangements would be needed.

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In all our discussion of this subject, we must understand that a large part of the teacher's preparation and the best part of it must be made while the teacher is engaged in teaching. The teacher who knows it all when he begins is hopeless from the start. He must be imbued with the spirit that thirsts for knowledge, and he must have right views of what constitutes education. Given these, there is hope for almost anyone, no matter from what school he has come, and without them, there is little prospect of anything but the most meager usefulness in the field of education.

Prof. F. E. Lloyd—I have only to say that I agree with the speaker in the main. There is however one point on which I wish to take issue. Prof. Harvey appears to be misinformed in regard to Teachers College, for we are, in that institution, trying to do the very thing he thinks we are not, namely, to prepare teachers in the best possible manner for high school teaching. And we believe that the results already attained justify the claim. We feel that Teachers College can meet the practical demands for the preparation of the high school teacher of the kind who can satisfy the ideals set forth by Prof. Harvey.

Prof. A. J. Grout—I have some personal knowledge of the matter, and wish to second what Prof. Lloyd says. I think he is fairly justified. I only wish however that all the teachers at Teachers College had Prof. Lloyd's judgment in selecting people who can teach.

With reference to the pedagogy of college professors, my experience from personal observation has been that a great amount of poor teaching is in the college. One professor said to me that it was so discouraging to call up man after man, and have him fail, that he preferred to keep on talking.

Prof. C. W. Hargitt—I would like to suggest that our friends can help normal schools in this direction by emphasizing one of the deficiencies of normal school teachers. In our state we have a good many normal schools, and most of them do not give anything like adequate preparation for the teaching of the sciences—one term in botany, one in physics and one in physiology. I have found that the pupils coming to the university from the normal school are not so well prepared in science as the average pupil coming from the high school. This is a mistake on the part of the normal school, and one which I think is in the power of those having control of the normal school to correct. There are normal teachers here who can confirm what I say. It is a mistake to give teachers the impression that with *one term* in chemistry, they can go out and teach chemistry scientifically.

Prof. Grant Karr—Prof. Karr speaks of high school graduates, and continues: Most of their work is textbook work, and that would give some reason for their lack of preparation. As for college graduates, I have had some of those to deal with in my work as superintendent of a normal practice school. I have had to deal with graduates of different colleges and universities. These young people come to us to get some knowledge of how to teach. Strange as it may seem, they do not get along any better with their practice work in the first few weeks than the average student who has done the regular normal school work. But such students are usually better in the long run.

Some of them seem to have such an abundance of knowledge, and are so deficient in ability to organize such a great flood of knowledge as to be seriously impeded in their work as teachers. One young lady, in particular, a college graduate whom I have in mind, was an entire failure at first, but after 15 weeks got hold of herself, and did much better work. Elementary methods and high school methods are the same essentially, though there may be phases in which they appear to differ very much. College graduates get hold of the practical work of teaching with little less effort than the person who has had less academic preparation. It seems to me that to get the highest development in the prospective teacher,it is necessary for the high school teacher to know something of the teacher's work in the grades. In that way he will come to understand method in its totality, as a principle. A preparation work that takes place in the grades, such as is provided in most normal schools, is a valuable foundation for high school teaching, and could be made use of with profit by high school teachers.

Section C. EARTH SCIENCE

REPORT OF THE COMMITTEE OF SEVEN

PRESENTED BY PROF. RICHARD E. DODGE, TEACHERS COLLEGE, NEW YORK

At the last annual meeting of the New York State Science Teachers Association, the following resolution was adopted:

> Moved, that the earth science section of the New York State Science Teachers Association request the president to appoint a committee of seven to consider the preparation of a series of exercises and suggest a course of study for public and high school laboratory and field work, and report at our next annual meeting.

In accordance with that resolution, the following committee was appointed by the president in the late spring and early summer: Richard E. Dodge, chairman, Teachers College, New York; Frank Carney, Ithaca High School; W. W. Clendennin. Wadleigh High School, New York; C. Stuart Gager, New York State Normal College, Albany; P. F. Piper, Central High School, Buffalo; Principal George H. Walden, Rochester; C. F. Wheelock. Head Inspector, Regents office, Albany.

Of this committee, Mr Piper has withdrawn because of illness, and two members have made no detailed suggestions. The report that is herewith submitted contains the opinions of four members only of the committee. Owing to the lateness in appointing the committee, no work could be taken up before Aug. 1. Aug. 8 a letter was sent to each member of the committee as it then existed, asking him to send to the chairman replies to the following questions, previous to Oct. 10, 1901.

1 Shall we organize a course based on the report of the committee of the National Educational Association or on the plan outlined in the *Academic Syllabus* of 1900?

2 Shall we plan a course that will call for a year's work in earth science and hence contain more of the geologic phase of physical geography than the course outlined in syllabus for 1900?

3 Shall we recommend that the course in geology be not included in syllabus for 1905?

4 Shall we plan a course for college entrance and indicate therein the special parts that should be omitted if the course is to be given in the first or second year of the high school, thereby fulfilling a double purpose?

5 Will you kindly take either the course suggested by the committee of the National Educational Association or the course of the syllabus for 1900 as a basis, and indicate what should be included in a course that will, to your mind, best fill the conditions recommended, and your answers to questions 1, 2, 3, 4 and send this to me to Teachers College, Columbia University not later than Oct. 10, 1901? Do not of course consider yourself limited to topics included in these reports; make as many additions or substitutions as you desire.

6 Will you please indicate in your course by check or by some simple means the points that you believe should be illustrated or amplified by laboratory or field exercises? This will give us a basis for organizing the exercises later.

Owing to the small amount of time available for committee work, the committee has decided to present merely a course of study this year. The chairman has had in mind not only the question of presenting a practical course of study in geography for high schools, but also a course of study which should improve on the present requirements of the Regents, and at the same time meet the requirements in physical geography as outlined by the College Entrance Examination Board of the Middle States and Maryland, requirements which are herewith presented as a basis of consideration.

Physical geography

The requirement in physical geography is based on the report of the committee on physical geography of the science department of the National Educational Association.

The following outline includes only the most essential facts and principles of physical geography, which must be studied in the classroom and laboratory. The material is for the most part common to the leading textbooks, though it should be recognized that no adequate laboratory manual is at present available. The order of presentation is not essential; it is recommended, however, that the topics be treated in general in the order given.

Outline

Recognizing that the field of physical geography in secondary schools should include (*a*) the earth as a globe, (*b*) the ocean, (*c*) the atmosphere, and (*d*) the land, the following outline is planned to cover these several large topics, with the further recommendation that the time allowance be proportionally increased in the order named.

EARTH AS A GLOBE

Shape of earth, how proved, consequences of shape
Size. How earth is measured; effects of size
Rotation: character of motion; latitude, longitude, and time
Revolution: rate, path and direction
Magnetism: compass, poles, variation
Map projection

OCEAN

Form, divisions, and general characteristics of the ocean
Depth, density, temperature of ocean waters
Characteristics of ocean floor
Distribution of life in oceans
Movement of ocean waters
  Waves—cause and effect
  Currents—causes, proofs of causes, important currents, effect of currents
  Tides—character of motion, cause of tides, variation of tides, bores
Work of ocean
  Classes of shore lines and importance of shore lines

ATMOSPHERE

Composition and offices of atmosphere
Instruments used in study of atmosphere
Temperature
  Source and variation of atmospheric temperatures
  Isothermal charts of world, January and July, with special study of isotherms of northern and southern hemispheres, of location of heat equator, of cold pole, of crowded isotherms, etc.
Pressure
  Measurement of pressure
  Use of pressure in altitude determinations

- Relation to temperature
- Study of isobars on United States weather map
- Distribution of pressure over world in January and July
- Relation of isobars to isotherms

Circulation of atmosphere
- Winds, classes, directions, causes, effects

Moisture
- Source, forms of, measurement of, precipitation

Storms
- Paths and characters of storms of eastern United States
- Daily weather at different seasons
- Relation of storms to general weather conditions
- Relation of weather to climate

LAND

General features of land as compared with ocean

Distribution of land

Map representation of topography

Changes in land forms, effects of elevation and depression

Plains
- Kinds of plains
- Characteristics of different kinds
- Development of plains
- Coastal plain of eastern United States in parts
- Alluvial plains, their formation and importance
- Relation of life conditions to different forms of plains

Plateaus
- Young plateaus
- Dissected plateaus
- Old plateaus
- Broken plateaus

Mountains
- Block mountains
- Folded mountains
- Domed mountains
- Massive mountains

Volcanos
- Distribution
- Character of at different stages

Rivers

- Life history of river—work of rivers, topography of valleys at different stages; lakes and lake basins
- Revived rivers
- Drowned valleys
- The great drainage basins of the United States

Glaciers

- Existing ice sheets
- Kinds of glaciers
- Work of glaciers
- Characteristics of glaciated area of northern United States

SUMMARY

Relation of man, plants, and animals, to climate, land forms, and oceanic areas

The outline given can but present the larger topics to be covered, and in a way suggest the point of view desired. Each topic should be treated so as to show its causal relations to other topics, and so far as possible the effects of earth features on life conditions should be emphasized.

The candidate's preparation should include: (1) The study of one of the leading secondary textbooks in physical geography, that a knowledge may be gained of the essential principles, and of well selected facts illustrating those principles. (2) Individual laboratory work comprising at least 40 exercises selected from a list not very different from the one given below. From one third to one half of the candidate's classroom work should be devoted to laboratory exercises. In the autumn and spring field trips should take the place of laboratory exercises.

List of possible exercises

Numbers in parenthesis indicate the value that should be given in estimating the total number of 40.

WORLD AS A GLOBE

Construct a diagram showing inclination of earth's axis, and effects of an axis at right angles, and parallel to plane of orbit (1)

Cause of day and night, and extent of sunlight over surface (1)

Construct a diagram showing position of earth, moon, sun, at the several phases of moon (1)

Construct a series of lines to one adopted scale, showing circumference and diameter of earth, and distance of several leading large cities from New York (1)

Determination of latitude, north and south line and high noon (1)

OCEAN

Study of ocean current maps (1)

Study of tide charts (1)

Study of types of shore lines (2)

Study of position of lighthouses, life-saving stations, and large cities in relation to southern Atlantic shore (1)

Study of map of world showing hights of land and depth of sea (1)

Explain selected steamer routes across Atlantic and Pacific (1)

ATMOSPHERE

Determination of altitude of hill by barometer (1)

Determination of dew point (1)

Comparison of January and July temperatures at 40° n. and s. lat. (2)

Location and migration of heat equator and cold pole (2)

Comparison of temperature over land and water at different seasons (2)

Study distribution of wind systems by seasons, and compare with pressure conditions (2)

Make isotherm and isobar maps from furnished data (2)

Find average wind directions about a storm center (1)

Making of complete weather maps from furnished data (2)

Study distribution of cloudiness and rainfall about a storm center (1)

Predict weather conditions from data furnished (1)

Find average rate and direction of motion of storm centers (1)

Study of condition of "cold waves" and "northeasters" (1)

LAND

Comparison of areas to scale (1)
Making cross-sections of contour maps to scale (4)
Cross-section of hachure map and changing hachure to contour map (2)
Writing description of models (4)
Writing description of pictures and accompanying map (2)
Construction of river profile (1)
Making drainage map of United States (1)
Written description of selected maps illustrating classes of land forms (4)
Planning a journey and describing country to be seen (1)
Locating illustrations of common land forms on some special contour map (1)
Four excursions in autumn, described in detail (8)
Four excursions in spring, described in detail (8)

At the time of the examination the candidate must present the original notebook in which he recorded with dates the steps and results of his laboratory exercises. This book, which should contain an index of subjects, must bear the indorsement of the teacher, certifying that the notes are a true record of the pupil's work. This notebook will be returned on request at any time within a year.

The committee has taken as its basis of work the recommendations of the subcommittee on physical geography of the committee on college entrance requirements of the National Educational Association. Three out of four of the members answering the questions proposed agree in recommending this report as a basis for our work; one member believes that the plan outlined in the *Academic Syllabus* for 1900 is superior in that it contains more than is proposed by the National Educational Association committee. The other members of the committee answering believe that the Regents report contains many unrelated and unnecessary facts, that it is less logical than it ought to be, and that we should plan a course "more prescriptive and yet giving freedom to the individual teacher." Three members of the committee believe that we should present a course of physical geography covering a year, and that geology should be dropped from the *Academic Syllabus* of 1905. This seems in line with the best thought in reference to secondary work as it now exists in the country. Three members of the committee believe that the colleges should accept for entrance a good course planned for the first or second year of high school work.

In accordance with these recommendations the following course of study has been worked out by the committee. This is a compromise course covering the accepted fields of physical geography, but there is a difference of opinion in the committee as to the order in which the larger topics should be considered. One member of the committee puts the ocean immediately after the earth as a globe; two members put the atmosphere in this position; and one recommends the ocean after the land.

It is understood, of course, that this plan as presented is merely an attempt to order the important related geographic topics pertinent to a secondary school course in a logical way, so as to produce under good teaching the best mental training on the part of the pupils. It is believed by the committee that mental training is more important than information as a result to be gained from geography work.

The course as outlined herewith should be presented in its larger topics, whether that presentation be in the first or last years of the high school course; but many details herewith included must be omitted if the course is carried on in the first year. Several members of the committee have recommended a special course on the physical divisions of the United States, or the physiography of New York state, as an elective in the advanced years of the high school, if the course presented here be given in the elementary years. The committee as a whole, however, makes no recommendations on this matter.

If the course outlined is adopted, and if the section desires to have recommendations later presented in reference to laboratory work, the committee should be continued.

Physical geography

Course of study for the high school

The earth as a globe

Topics marked * should not be included in a first year course.

- The shape of the earth
  - *Historical. Eudoxus
  - *Problem. If the north and south line of the surface of the earth were represented in profile by either of the following lines, how would the aspect of the sky be affected in each case by moving along the line? 1——; 2 ‿; 3 ∧; 4 ⌒.
  - *Aristotle. The earth a *small* globe
  - *Strabo (beginning of the Christian era), first gave the argument from the appearance of ships at sea
  - Simple proofs of shape of earth
  - Results from living on a globular gravitating earth
- The size of the earth
  - *Eratosthenes and the well at Assouan (Syene)
  - *The caliphs (11 cent. A.D.), Cassini in France (late 1600 or early 1700), Newton, Richer, French Academy (1675)
  - Effects of size of the earth on human life
- Motions
  - Rotation
    - How known
    - Character of the movement
    - Consequences of rotation—defining direction, determining relative position, measurement of time, day and night, flattening at poles
      - Life effects due to rotation. Application of shape and rotation to
- Latitude and longitude
  - Origin of the terms
  - Necessity for parallels and meridians
  - Longitude
    - *First determined by Strabo. How? Chronometer method and telegraph

    - Determination of a north and south line
  - Latitude
    - Determination of local latitude by the sun circle method, and by the altitude of the sun as determined by a north and south line
    - Use of latitude in navigation
    - Application of latitude and longitude to
- *Maps and map projections
  - Need of maps. Meaning of the term map
  - How maps are projected
    - Orthographic, conic, Mercator projections
- Revolution
  - Rate, path and direction of revolution
  - Construction by pupil, from given data, of the exact shape of the earth's orbit. Seasonal distribution of energy
- *The earth as a magnet
  - The compass
  - Determination of local magnetic meridian and angle of variation
  - Isogonal lines
  - How the life of man is affected by living on a magnetic earth

The atmosphere

- An invisible gas
- Composition
  - Gases. Dust. Relation of different components to plants and animals, including man. Relation of atmosphere as a whole to the life of man
- Introduction of summary of weather and climate elements, as illustrated by selected days
  - Directions for taking weather observations, and explanation of instruments used
  - Temperature
    - Source of atmospheric temperature. The nature of heat; how measured
    - Thermometers—centigrade, Fahrenheit, maximum, minimum

Relation between angle at which rays strike and their intensity. Diurnal changes of temperature

Distribution of heat—vertical, horizontal; need of graphic representation of temperature distribution. Isotherms. Study and explanation of isothermal maps of January and July and annual average of northern and southern hemispheres

The heat equator. Its migration north and south, causing

The change of seasons—explanation with individual apparatus

Crowded isotherms and their explanation

Relation of life to seasonal and diurnal temperatures

Atmospheric pressure

Introductory—demonstration and measurement of pressure

Method employed—aneroid and mercurial barometers—barometric readings—*when taken—*reduction to sea level

Determination of altitude by means of barometric pressure

Expression of pressures by isobaric lines. Seasonal isobaric conditions

Relation of pressure to temperature

(In first year work no such detailed classification should be attempted. A description of the general system of winds and a study of the relation to temperature and pressure conditions is essential, however)

Winds. What is a wind? Direction of motion

Methods of observation, measurement of velocity, classification according to velocity, etc.

Winds consequent on a rotating planet (planetary)

Trades; prevailing westerlies; doldrums; horse latitudes; upper currents. Relation of wind belts to isobars and isotherms

Location and characteristics of each belt

Winds consequent on a planet inclined 23½° on its axis (terrestrial)

    - Seasonal changes. Shifting of calm belts—consequent disturbance of path of winds—effect of earth rotation
    - Seasons and character of life in each area
  - Winds consequent on distribution of land and water (continental)
    - Continental winds
    - Monsoons
  - Winds consequent on diurnal conditions
    - Land and sea breezes
    - Mountain and valley breezes
- Humidity
  - Moisture as it exists in the air—*how measured
  - Origin of atmospheric moisture. Evaporation
  - Humidity—absolute, relative. Relation of temperature to absolute humidity
  - *Hygrometry. Condensation, dew point, saturation
  - Precipitation. Dew, fog, cloud, frost, hail, snow, and rain—how recorded in amount. Study of rainfall chart of the world
  - Relation of rainfall to interests of man
    - Agriculture (discuss value of irrigation)
    - Forestry
    - Manufactures
    - Commerce
- Storms of the westerly wind areas
  - Control of the weather by storms
  - Characteristics as to temperature, pressure, winds, cloudiness, rainfall
  - Path and rate of progress
  - Hot and cold waves, northers, blizzards, etc.
- Study of weather maps[1]
  - Local observation begun at the commencement of the work on the atmosphere. Weather predictions. Weather Bureau instruments, economic aspect

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[1] This topic should be made brief in first year classes.

- Summary of weather and climate
  - Weather
    - Characteristic summer and winter weather of eastern United States
    - Study weather signals employed by United States government
  - Climate
    - Relation of weather to climate. Most important climatic elements
    - Climates of the different heat belts
      - Subdivisions according to varying character of different portions—land and water, coasts and interiors, mountain and plateau
      - *Dominant climatic features of these subdivisions
      - *Seasonal conditions; effect on life
    - General relation of climate to vegetation, animals, man

The ocean

- Distribution of land and water
  - To be studied from a globe. Land and water hemispheres—London as a center of land hemisphere
- Physical characteristics of ocean water
  - Density. *Causes of variation in density. *Color and phosphorescence. Temperature. Greatest variations—where found. *(Study of charts and diagrams, showing distribution of ocean temperatures, with causes and consequences of observed facts)
  - *Character of the bottom. Comparison with land conditions
    - Ooze—Globigerina (Foraminifera)
    - Absence of weathering on ocean floor, and its results
  - Depth—average—where greatest
    - *Divisions of oceanic areas
      - Great oceans; depth and volume compared with extent and elevation of land surface
      - Mediterraneans—relation of important ones to continental masses
      - Significance of temperature peculiarities

- Submerged continental shelves—relation to continental masses
- *Ocean life
  - Very varied. Shallow water and deep water life, and their comparison
- Movements of ocean water
  - Easy—slight friction
  - Waves—Cause. Wave motion; *definition of wave parts—crest, trough, front, back, hight, length, velocity, period; limit of wave hight; use of oil at sea; effect on waves of shoaling; undertow, surf, breakers; how waves strike the shore; focusing at headlands
  - Currents—how known to exist; description, location, classification (warm, cold), deflection by continents and by rotation of the earth. Cause—*inadequacy of convection theory; comparison of charts of ocean currents. *Hypothesis that winds are the cause; *testing the hypothesis that winds are the cause. Important currents, oceanic eddies; economic importance of currents
  - Tides.[1] Description of tidal phenomena as observed along shore; comparison of tidal phenomena with phenomena of waves; comparison of tidal periods with lunar periods; explanation of tide-producing forces with diagram; testing hypothesis that tides are caused by the moon; spring and neap tides, bores, tidal races; economic aspect of the tides

The land

- General features of the land compared with those of the ocean
- The materials of the earth's crust
  - Mantle rock; bed rocks; the more common rocks and their general characters; stratification and its explanation
- Weathering—origin of soils
  - Evidences and agencies of weathering
  - Results—formation of soil, widening of valleys
  - Strong rocks, or ridge and highland makers

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[1] This topic should be treated briefly only in a first year course.

Weak rocks, or valley and lowland makers
Crystalline rocks, and their effects on topography
Stratified rocks, and their effects on topography, as determined by their relative strength
The work of the wind
Blows dust and sand—beaches elevated, loess, sand dunes; erosive action—ledges attacked, faceted pebbles; importance—enriches soil by distributing it; wind action checked by vegetation and moist climate
The work of water on the land
Fallen rain
Evaporates; sinks into the ground; runs over the surface, resulting in erosion; definition of a river, river system, basin, divide, watershed
The erosive work of a stream. Relation between transporting power and velocity
Results of erosion. Evidences that most rivers have carved their own valleys
Formation of tributaries by the gnawing headward of gulches
Young, mature, old, river valleys. Characteristics of each. Base level of erosion
*Migration of divides. Economic importance of this. Stream capture and beheaded rivers
Drainage systems of home locality, New York state, United States, world. Interior drainage basins
At first the topography guides the course of the streams, later the streams determine the topography
Impediments to the work of rivers
The work of a stream is impeded when its velocity is checked
At maturer portions due to base leveling
By the ocean and lakes
Results of impeding the velocity of streams
Deposit of sediment in the bed of the stream along the banks (flood plains), at the mouth—Study of cross-sec-

tions through flood plains. Economic importance, e. g. lower Mississippi jetties

Deposits at mouth of streams—Alluvial fans, deltas, continental shelf. Conditions of their formation. Results. Length of stream not constant

Effects of depression of rivers. Drowned valleys

LAKES

Relation of lakes to rivers. Distribution of lakes in United States. How made

Lakes in glaciated regions. Oxbows and cut-offs in alluvial plains

Lakes in arid regions. Bonneville, Lahontan

Lakes in volcanic regions

Lakes contrasted with waterfalls and rapids. Ultimate destiny of lakes

GLACIERS

Characteristics of glaciers

Snow field, névé, ice stream

Resemblance to rivers

General characteristics and distribution of existing valley, piedmont, and continental glaciers

Work of glaciers

Erosion, scouring, and scratching; transportation and deposition—moraines, lateral, medial, ground, terminal. Other deposits—drumlins, eskers, kames, overwash plains, valley trains

Ancient glaciers—the ice age in America (North)

Effect on topography and drainage

*The Laurentian lakes and Niagara. *The "Finger lakes" of New York state

UNDERGROUND WATER

Springs—conditions of their formation

Kinds, special mention of—artesian wells, hot springs, geysers

Solvent power of underground water. Limestone caves

*Reasoning from the phenomena of hot springs and geysers, what is the temperature condition of the interior of the earth, leading to other evidences of internal heat as found in the study of

CLASSIFICATION OF LAND FORMS

Necessity of expressing land features by maps. Interpretation of maps

Maps showing
  Relief, shading, hachure, contour lines
  Comparison of contour maps with pictures of the same locality (or with direct observation, if of the home locality). Written descriptions of topography from map reading
  Drawing of cross-section profiles to scale from contour relief maps
  Field work in mapping and in cross-section drawing

Plains
  Of construction
    Coastal plains: characteristics, structure, origin. Early shore line and subsequent modifications. Drainage and dissection. Water supply. Fall line—how formed. Influence on human occupation and activities. Stages in development: youth, maturity, old age
      *The geographic cycle
    *Classification of coastal plains: narrow, broad. Examples of each. *(Ancient coastal plains: New York, Wisconsin, England)
      Geographic controls on coastal plains
    Effects of coastal plains. Examples

Effects of earth movements on position of rocks
  Dip, strike, folds, tilts, etc.

Mountains
  Essential idea of mountains. Brief suggestion of causes of mountain building
  Block. Young stage, e. g. northern California and Nevada.
    Characteristics; how formed, drainage, and dissection
    Earthquakes and their significance here. Effects on distribution of life

- *Dissected block mountains, e. g. Utah
  - Characteristics. Effects of dissection; climate; control of human occupation and life
- Folded mountains, e. g. Juras, Appalachians
  - Characteristics; topography. Drainage and its modifications
    - Stream capture
- *Domed mountains, e. g. Black hills
  - Treated as block, dissected block, and folded mountains

Plateaus

- Young, e. g. Shiwits
  - Compared with plains of construction as to surface, structure, elevation, drainage. Effect on man
- Dissected, e. g. Catskill, Alleghany, Cumberland
- Old, e. g. New Mexico
- Mesas, buttes. Ancient civilizations of North American aborigines
- *Broken. Character, drainage, relation to man

Volcanos

Definition of volcano. Relation to the life of man and to the lower organisms. Features of young and old volcanos

- Description, distribution, causes. Mapping of volcanic regions

Earthquakes

- Description. Regions of greatest frequency. How observed; causes; relation to man

Plains of destruction

- Characteristics, specially as seen in southern New England
- Contrast with construction (young) plains
- Terms—pene-plain, monadnocks
- Relation of plains of destruction to other land forms
- Effect of uplift. How old plains differ
- Drainage—comparison with that of young plains
- Culture relations; effect of change of base level

Shore lines

- Meaning of terms shore line and coast

On what does original outline of coast land depend?
Classification of shore lines
  Number of classes—how produced; characteristics
  Elevated shore lines
    Characteristics
    Changes effected by the ocean
      Sand reefs—formation; advance and retreat; deltas and bays
      Inlets—relation to coastwise traffic; tidal deltas
    *Effects of depression and elevation on this class of shore lines
    Effect on man; distribution
  Depressed or drowned shore lines
    General characteristics; relation to man's life
    Changes effected by the ocean
      Formation of sea cliffs and benches; sea caves
      Formation of bay head beaches and retreat of sea cliffs; *formation of barrier beaches and general retreat of shore line—*effect of strong tides
      Land-tied islands—process; importance to man

Summary and conclusion[1]

The relation of all life, specially that of man, to geographic environment. Adaptation to changes in environment. Gradual mastery of environment by man with the advance of civilization. Importance of geographic control as shown by historical and commercial facts.

THE EARTH AND MAN

Summary and review

Civilization as related to environment
Environment exercises strong control over barbaric races. Examples
Civilized peoples
  Control of the past

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[1] In a first year class it is recommended that the summary of the course be merely a review of the principal points in life geography that have been touched on in the progress of the work.

  - Control of the present—less marked. Ability to overcome existing conditions
  - Traveling across the continent today compared with difficulties encountered half a century ago
- Relation of surface features to man
  - Mountains—barriers due to trend, steep slopes, lack of water, rarity of air
    - Effect of barriers on the settlement of a country, e. g. influence of the Appalachian barrier on the settlement of the United States
      - Determined lines of settlement
      - Directed and limited immigration and migration
      - Strengthened early settlements
      - Offered protection from enemies
    - Dangers arising from a sharp line of demarcation between a people
      - Comparison of natural and political boundaries
      - Relation of pioneer settlements of Mississippi valley and Atlantic states
    - Effect of barriers on the development of a region
      - Growth checked through limitation of boundaries. Newburg and Fishkill compared
    - Effect of mountains on life of people
      - Characteristics of mountain dwellers—Scotch, Swiss, etc.
      - Differences in a people arising from separation of valleys, e. g. clans of Scotland
      - Slow development of isolated mountain dwellers. Mode of life of the natives of the mountains of Tennessee and Kentucky
      - Influence of mountains on industry
  - Valleys
    - Gateways for exploration
    - Regions of early settlement. Compare the settlement of the Mohawk and the Hudson valleys with that of adjacent mountains and plateaus

        - Importance commercially, e. g. Hudson and Mohawk valleys a great factor in determining the supremacy of New York city
        - Highways of travel
    - Plains
        - Seat of early civilization, e. g. Chinese—developed in river plains of China. Hindus, in plain of Ganges
        - People of great plains—tendency toward a nomadic life. American Indians, Arabs of the eastern deserts
        - Influence on settlement. Uplands and lowlands of New England compared
        - Influence on industry
    - Seashores
        - Regular—lack of harbors unfavorable to development of great nations
        - Irregular—favorable to growth of nations, e. g. Greece and Rome
            - Great nations of today
        - Influence of seashores on industry
- Relation of climate to man
    - Effects of extreme heat, of extreme cold on man's mental and physical activity, e. g. dwarfs of the African forests, Eskimos of Greenland
    - Effects of a temperate climate on man. Heat belts in which the great nations of the world are found
    - Dry climate—importance of control directly on vegetal life, indirectly on animal life and man
    - Industries of semiarid plains and plateaus
    - Industries of well watered regions of gentle slopes
    - Rainfall east and west of 100th meridian w. longitude noted—effect on industry
    - Industries of regions of extreme cold—of tropical regions
- Relation of economic products to man
    - Effect on migrations. Discovery of gold in California, in Australia. Influence on industry

Influence of man on the earth
  Modification of environment. Land reclaimed from the sea—dikes built, streams diverted, hills leveled, marshes drained, deserts made fertile, etc.
  Distribution of plants and animals influenced
  Destruction and limitation of plant and animal life, e. g. buffalos, seals; forests—effect of destruction of forests
  Distribution of plants and animals extended

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Wright. Ice Age in North America. Appleton. New York

SUMMARY

Guyot. Earth and Man. Scribner. New York

Redway. New Basis of Geography. Macmillan. New York

Shaler. Nature and Man in America. Scribner. New York

Small & Vincent. Introduction to the Study of Society. American Book Co. New York

Trotter. Lessons in the New Geography. Heath. Boston

[The discussion was led by Head Inspector C. F. Wheelock, of the Regents office, who emphasized the necessity of having a course sufficiently elastic to allow the local environment to be used by any teacher, and further one that would allow each teacher to make special use of the facts and methods most familiar to him.]

Miss Elizabeth E. Meserve—I hesitate to criticize the combined mental work of seven men. Nevertheless, I shall speak from the standpoint of a teacher in the secondary schools and teacher of physical geography. For whatever these men may decide on as a suitable collection of facts for a course, the work of teaching this will probably fall to a woman.

First, in regard to the suggestion that physical geography be made a full year's course. If this course is to come in the first or second year of the high school, I say *no*. I object to teaching physical geography in the first year as the course *now* stands. I believe that much of the so called physical geography can be taught in the grammar schools in connection with the course in geography, reserving the more difficult part not for the high school, but for college. The pupil comes up to the subject of physical geography, as the course is now planned, with no science to help him, and he has what should be a review of many of the sciences before he has had the subjects themselves. I am not in favor of offering physical geography as a college entrance subject. The pupil, in my mind, will receive more mental training from some definite branch of science. When we teach physical geography in the first year, we are hampered in the very beginning of our work. In order to understand the motions of the earth and their relations to the physical conditions on the earth, the atmosphere and the movement of the ocean waters, some knowledge of the principles of physics is needed. To understand the earth's crust, its structure and the resulting forms, the pupil needs some knowledge of geology. So much of our time is spent and must be spent in teaching some of these principles that we almost forget just what we are supposed to be teaching. And it leaves so little time for the relations which exist between the earth and the life on the earth, that these things come in, in many cases, like the moral to a story.

Our work is too fragmentary; we touch on too many things. In botany, zoology, physics, or chemistry, we bring the pupil to some place where he has the feeling of something definitely accomplished.

The course as submitted by the committee of seven differs from the Regents course in leaving out some of the unrelated matter, or very distantly related matter. This also enters more into details, too much so, perhaps, in the subject of the land.

As to the order of subjects, it seems to me a minor matter, as teachers must adapt that to the time of year in which the subject is taken up. Under the subject, " the earth as a globe," as outlined in this course, I believe we should omit the historical references, referring to them in a very general way, but making no definite study of them. The pupil in the first year has but little knowledge of history, and names of famous astronomers and physicists mean nothing to him; neither do dates appeal to him as interesting topics. Then, too, for the best understanding of these problems, more knowledge of mathematics is necessary.

I believe we should emphasize rather more the importance of the subject of latitude and longitude, the location of places, the differences in time, and the uses of latitude and longitude in navigation and surveying.

The facts in regard to maps I should leave till later, unless I forget it altogether. Logically, of course, it comes in at this place in the outline. But practically it will be much better understood much later in the subject. After the pupil has done some field work, and made careful plottings in his notebook of local places, indicating position of lakes, forest regions, hills or mountains, and traced the course of one or more rivers (for a part of its journey); after he has done all this, the use of maps will be quite clear to him, and relief, shading, hachure and contour lines will stand for something more than vague terms. I am not sure that it matters whether he ever knows just how the Mercator or orthographic projections are made. He will know the practical value of a map, and can interpret it intelligently.

We are inclined, in plans for physical geography, to place too much stress on the subject, "the earth a magnet." We expect the pupil to understand all about magnets, and to apply that knowledge hastily gained, to the consideration of the earth as a huge natural magnet. We expect him to talk intelligently about the magnetic needle, its variations and its use in the compass. At this point the Regents call for a certain ability to name "electrical phenomena." I am glad that this is omitted in the outline. The word phenomena carries a great deal of fear with it any way, and, when you prefix to that "electrical," with all the strange misunderstood and non-understood qualities of electricity, the pupil is overwhelmed with the awfulness of the things he has to remember, and he associates, instead of our beautiful aurora borealis, electrocution as an electrical phenomenon.

Under the topic, "physics of the atmosphere", comes a great difficulty. We forget that we have made the jump from magnetism to heat and pressure. The principle of the thermometer and barometer must be mastered. The isotherms and isobars must be fully understood. Very little can be done with the subject, "light", as the average pupil can not understand, at this stage of his mental development, the principles of refraction and reflection. Winds, humidity, storms and the weather charts, supplemented by actual observations on the part of the pupil, require a large proportion of time.

Under climate, considerable time must be spent on causes. It is quite necessary that the pupil be able, not only to state the width of the different zones, but to tell why they are of such width.

If we ask pupils to tell about "the midnight sun", we receive strange information. Is that to be wondered at when grown people remain confused? A man, in giving a stereopticon lecture to children of the grammar grade, made this statement. He had shown a picture of "the land of the midnight sun"; "And now, children", he said, "the peculiar thing is this: the sun does not rise in the east and set in the west, but it comes up anywhere and goes down anywhere."

At first I thought that the outline was altogether too long on "the ocean"; but I soon discovered that at least one third of the outline is what we usually class under the topic, "the land". This leaves the description of the ocean bed, something of the temperature of the ocean waters, and the life in these waters, as minor subjects, to be treated briefly. Some time should be spent on the subject of currents, but *tides* the pupil can hardly comprehend.

Of course the main work in physical geography is that which comes under the topic, "the land". This we want to make as complete as possible, and yet keep out as many technical terms as we can. I hope a course in physical geography may be prepared which will combine the simplest facts—perhaps better, the most closely related facts of the earth, its influence on plants and animals, and man's relation to the physical conditions of the earth, and his part in the distribution and destruction of animal and plant life.

[The third speaker was Prof. Albert P. Brigham, of Colgate University, who spoke from the standpoint of the college. Prof. Brigham proposed some minor changes in the text, and spoke in reference to the preferred order of the larger topics. He emphasized further the necessity of having one year's continued work in physical geography, if the work is to give training proportionate in value to that given in the more exact sciences.

Under the five minute rule the report was further discussed by W. W. Clendennin, of the Wadleigh High School, New York, by Frank Carney, of the Ithaca High School, and by Prin. George H. Walden, Rochester.

At the conclusion of the discussion the section voted to ask the association to continue the committee of seven one year, to draw up a series of laboratory exercises in physical geography, to accompany the report of this year, and to outline a course in geography for elementary schools.]

Section D. NATURE STUDY

Prof. C. R. Drum—I feel a little out of place opening the subject this morning. I know very little about nature study. I have tried to do a little work along that line in the vacation schools of Syracuse. We had five last year. On the average we took four or five hundred pupils into the country every week. I always accompanied the teachers on the trips.

I ought to speak just a word about the class of pupils. They are pupils from the congested districts, the crowded districts, from what we might call the lower strata of society largely. Of course not all; they are newspaper boys, etc. Last year we did nature work for boys, this year, for both. I intended to prepare a definite, concise paper, but my little boy was sick and I was unable to do it; so I shall have to give you four or five little illustrations from our work. First, I want to speak of the garden at Fraser school. As soon as the Board of Education decided to have a summer school at Fraser, the teacher who was appointed to have charge of that school immediately began to put in a little garden over there. The children were interested in the garden. People said it was no use, "because, if you do, the bad boys in the neighborhood will destroy it." It is a fact that the garden never was touched. One of the most troublesome boys in the school went one time and planted a little vine in that garden when there wasn't anyone around. And do you know those fellows protected that garden? No one would think of going into that garden. I assert that there is a certain amount of moral training there that ought to be duplicated everywhere.

In another school a boy brought down a big, green caterpillar. He brought it down to have me see it. I did not get down to that school that day. He had it in a box. He kept it over night. In the morning, the next day, when I arrived, he brought out his box to show me the green caterpillar; and during the night that green caterpillar had begun to weave his cocoon, and had it partly woven. It was thin all over the body, and a more surprised boy you never saw in your life than that little fellow. I imagine that boy will pick up all the green caterpillars he can find forever after. I think he has the cocoon. That boy will some day be a scientist, I judge, because of his interest, and will create an interest for those things in the other boys with whom he comes in contact. That boy will be a scientific investigator. There is no question about it. He is so interested in it. He might have read that in the book, but it would not have had the same interest as to get the knowledge firsthand.

There is another illustration which I wanted to bring up. A group of boys from the summer schools begun last summer, were looking intently at an object on the ground. They were apparently very much interested in something. A teacher in a school, passing, saw them. She approached the crowd and inquired of one of the boys, "What are you looking at?" He says, "Looking at a toad down there." He said that Mr Smith told them the story of the toad, all about the toad, many interesting things about it, and told them the next time they saw one to watch it. Now, good seed always bears fruit. The teacher who told the story of the toad little thought of the interest he had created in one of God's most humble creatures. Ordinarily those boys would have kicked the toad off the sidewalk or hit it. That is moral, ethical training, and those boys are becoming investigators, and some day some one may be a scientist. They are getting the spirit of investigation in this nature study work.

We took trips to the Valley, up into the Glen, and on one of the trips I went up into the Glen ahead of the boys. They were interested in the appletrees which no one in particular owned, and they would climb the trees and help themselves to the apples; and I stepped up into the Glen. I saw a chipmunk on the sidehill, and I sped back as quietly as I could and told the boys I wanted them to see and come quietly. You have read Cooper's description of the Indians when they were after anything, how they would go. I imagine those boys got up into the Glen something like that. A large number of them had never seen a chipmunk, and the interest, pleasure and profit they got from watching that little fellow seemed to me wonderful. I felt that not a boy there would ever take an air gun and shoot a chipmunk. I used to when I was a boy; liked to shoot red squirrels and chipmunks, etc. No one taught me any better.

Those lessons give to the children a desire to love all of God's creatures; and you must appreciate the fact that these boys are the boys of our streets. A little farther up the Glen a group of girls were watching something on the rock, and, when I arrived there, they were interested in a snail. I believe in our trips; on the trips we collected a great deal of material. We did not have anything but what we would use in the next week's work. Each school had a trip one day in the week. They were watching that snail and were much interested in everything they could see. I never had so many questions asked me before in the world, and so many I could not answer. I had to say we would endeavor to find out. The interest in nature of those little fellows was marvelous. The chance of a snail with the house on his back, crawling along, to teach a lesson of God's care of His creatures!

Nature study not only teaches children to observe and investigate, but it turns their minds to the moral side, and also to the ethical and to the religious, if I may say so. It seems to me it is one of the most fundamental subjects we have to deal with.

After the vacation schools closed, I went down to Otisco lake fishing. I was seated in the boat fishing, and hooked on a crab. It would squirm a good deal; I threw it into the water over there, and by and by got hold of a bass. Do you know that during the first part of the trip I enjoyed that immensely, but somewhere from my subconscious self there loomed up something, an impression, and I said, "My pleasure is the suffering of that poor bass over there." I was fishing for fun, not because I wanted something to eat. The impression came to me that that was wicked. Where did I get it? From my nature study trips with the boys. In trying to help them, something seemed to react on me. I declare, I went down for a two days' fishing trip: I stopped fishing and went in, and went home. Perhaps it was foolish and perhaps wrong, but I felt that way. I have not been fishing since. I may go again sometime; but that is the way I felt that day. Men will go up into the woods and shoot the deer. Boys brought up to nature study won't do it. To get a fine photograph of one is better than to do that.

We took from 50 to 150 children on the trolley. Usually had three or four teachers. They were very well behaved. This summer they paid their own fares. Last year I paid all the fares. Perhaps it is just as well to have them pay the fares. Oh! how they enjoy it! It gives them such a fund of material. If they went out without direction, nothing would be applied, but direction of attention is necessary. We had no particular object in view except to get out. We simply, if we ran across anything like the snail or chipmunk, observed it; or, if we found something to bring home, we brought it. We played games after we had the little trip, half or three quarters of an hour.

Cornell University sent some excellent help down year before last. They gave me most of my ideas on nature study work. Mrs Comstock, Miss McCloskey and others.

I had been over the ground a good many times. The teachers had to answer the questions, "What's this?" "What does it mean?" "What is it good for?" "What does that do to you?" I never felt my ignorance so much in all the world as I felt on the trips. I was perfectly frank. I did not assume to know what I did not know.

The boys who went the first year became leaders the second year, and they know a whole lot of things. I have in mind one boy in particular who developed quite an interest from the previous year. He was delighted, too, to be one of the leaders. He had a little crowd, and could tell them many things, which was due to the fact that they get a little material each time, and that was added to.

I had no previous training. A little zoology out of a textbook at normal school; and I had studied geology some—that is all. The only thing is to begin, and you learn a lot. I have learned quite a little. I have been obliged to. A child brought a beautiful moth over to my house. I have been looking it up and finding out its history. There is a great deal of enjoyment and satisfaction in it.

John W. Spencer—Yesterday afternoon the discussion ran on the minimum amount of scientific knowledge a teacher should have in order to have a license to teach nature. This morning we are trying to bring up evidence that a person without any knowledge and with a love of nature can teach something. The main thing is to have a handle on what little we do know, so we can bring it out. As I said, Mrs Miller anticipated that point. I was going to ask about it.

Prof. Drum—I intend to be able to pass the examination later.

John W. Spencer—Then, Prof. Drum, you believe that one of the important features is to inspire the children as to new reasons?

Prof. Drum—Yes. If you can start them off and keep them moving they will get enough to keep them going all their lives. I gave those illustrations with the thought that those boys will continue in that line.

John W. Spencer—In your boys you have excited wonder and interest; and, whatever they saw, they felt as if it had meaning and wanted to know the meaning? That is your method?

Prof. Drum—Yes.

Mrs Miller—Miss Whittaker, of Brookton, has had some experience with carrying on clubs of nature study; clubs for children. I have asked her to tell us something about the club, how it began, how it continued, and what she feels has come of it.

Miss Elizabeth Whittaker—To begin with, I feel that I have not done any nature study work. I never heard of nature study till November 1900, when I received a circular letter from the university and the directions for the organization of clubs. I had been fond of the study of nature; and, when I began teaching in September, I went out with the children two or three times each week into the country. Nearly all geography work was done through these excursions or walks. The leaflets were a valuable aid; and, in case I became puzzled, I would write to Mr Spencer to find what next to investigate to understand clearly the matter in hand, or what book would give the desired information. The idea came that perhaps I could make a club serve to discipline the room, a sort of self-government scheme. I asked the children one night to stay after half-past 3 and talk about organizing a club for the study of common things and the taking of regular walks. I told them I thought it would be a good idea to start with few people. I decided to take 12, a certain number from each grade, chosen from those having the highest standings. The best work counted most. I told them that each morning for 10 minutes we would talk about interesting common things. They might bring anything to school they liked. Any one might speak. All had the full privilege just as much as the members. I used the 10 minute talks to prevent tardiness. There were 73 cases the year before, which I did not like. I told them that the club members could write to Mr Spencer once a month; those not club members could not have the privilege. Club members could vote. Voting was to them, a wonderful thing. I read the names of the pupils who were to be the charter members; and told them for a while we would hold an election once a week, and, if their work was good enough, others could come into the club. Out of the 12, six were chosen to frame the constitution. The constitution adopted required that every child's standing should be 90% to remain in the club. They required more than I expected. If any member of the club was not almost perfect in deportment, by a two thirds vote of the school, not of the club, he should be dropped till he recovered. If the work was below 90, he was not required to do any club work, so that he might have an opportunity to catch up in his studies.

The plan succeeded, I think, because last year, after the club was organized, I had six cases of tardiness against 73 the year before. This year, two cases. One child came without his shirt waist because he was not going to miss the talk. His mother came 10 minutes later, very much disgusted. She had the shirt waist. As for discipline, we suspended two pupils during the year. One was dropped for fighting on the way home from school. He is back in the club this year. Out of 38 children the week before last, we had 28 members. The other 10 scholars are striving hard. Some have 88 and are trying hard for 90. The language work has improved. They write the letters at home. Those who are not members write more than those who are. I showed the members' letters to two ladies, and they read 17 letters before they stopped. They enjoyed them. Every one by eight year old children.

In September we began studying seeds. Then we studied grasses and then began to study the soil in which these things grow. We live in the suburbs, and could look at the soil. We made window boxes and planted these various seeds and watched them grow. We next studied the nature of the soils in the country where the fruits we have grow. In fact, we have done all our fourth grade geography work since September, and are getting the fifth year work well in hand. They work all the time that way. We don't seem to do any nature study proper. It just seems to go in with the school work.

We have five caterpillars; we had one to begin with. They live in a cricket cage. One boy is very fond of them. The children used to take turns in carrying them around in their hands. One boy would occasionally manage to keep one in his pocket. One day we had a caller. The smallest caterpillar used to take excursions for about an hour and go back to its cage. This lady stepped on it. We thought it was dead, but after a little while the caterpillar was crawling around. The next day the lady sent down four caterpillars to make up for the one. Out of school hours, the five are usually crawling around on some boy's hand, while some one is playing a mouth organ to see if they can hear. Occasionally a caterpillar will rear its head, and they insist it can hear.

I did not know that I was undertaking nature study work when I began. I was always out of doors with my father on the farm. I would often sit half a day in an appletree and watch a bird build a nest. In high school I had physics, which helped me a great deal. Physiology did not help much, so far as I know. Physical geography helped me about climate and atmosphere, while much reading helped a great deal. I told the children I knew nothing about nature study and took the attitude of a learner with them. That is why they have worked so faithfully with me.

Mine is practically a rural school. We have about 80 children in the school. I have 38. There is no work of this kind done in the higher grades.

About the kinds of soil—we found the kind in which the grass grew. As there is a hotel in the place, I spoke to the keeper for her tin cans. The boys made window shelves. We had good success with the seeds. One father came to me and wanted to know something about rotation in crops. He asked me what to plant next year after potatoes.

Mrs Mary Rogers Miller—Miss Hill, of Syracuse, has had problems which have been somewhat different from Miss Whittaker's and Mr Drum's. She will tell us how she managed them.

Miss Mary E. Hill—I am a teacher in a private school, and I have the charge of nature study work and also teach two sciences. Having only 10 minutes, I wrote out some of the preliminary things I wish to say; and, then, I have some of the children's work which I thought would illustrate a little my matter.

Nature study was introduced into this school about four years ago, and was soon after made a permanent part of the work. I found to my surprise that the oldest class had some decided opinions which had to be overcome. Previous to this time I had not taught young children. I had taught science work to older children in other schools, so that practically the nature study itself was a little new, as nature study is not taught exactly as the sciences are, though the method is fundamentally the same in all nature study.

Of course, as everywhere, the children are given the living specimens, and learn to make their own observations. We use drawing, because I think it is exceedingly valuable in making them see exactly and find out what they have not seen just right. The trips and field excursions are an important part of the work, and I have as many as possible, though fewer than I wish. At first it was hard to get the children together because they had many outside interests. Boys' athletic clubs interfered a great deal, and one of the highest tributes to the work was given by a small boy on one of these trips. He looked up with a glowing face and said: "*This* is as good as baseball." Another boy said he would rather have a week in the country than a month in the city. One of the things which is encouraging to me is that they do things at home without being told to do them. I found that suggestions to do things at home did not always bring good results; so I ceased to give them, because I found that, if they were interested, they would do things without being told, and, if they were not interested, they forgot. Sometimes they bring things to the class, which I use. I always use these specimens because I wish to encourage the children to bring them, but never depend on the children to bring material at all. One child saw two woodpeckers fighting in the spring. Though I don't like to use dead material, I did use those to show the interesting features of woodpeckers. Another child brought a live bat. That was an interesting study. It was a good subject for study. One thing I remember they said. When a bat was disturbed, it gave out "a nice perfumy smell." It is true. I never knew that; and some people might not consider it as pleasant as the children did. He climbed about on the netting and, when let out purposely, he flew about and fell on the floor. They found he could not stand on account of the way his legs were attached to the wings.

I find also that in the summer, after their vacations, they have a great deal to tell me when they come back. Most of them are fortunate enough to spend their summer vacations in the country. They sometimes repeat work at home that is being done in the school.

I have this fall a new room for the work, which is very large and light, having seven large windows which look out on the yard, in which a number of trees are growing, some young and some old. I have a better opportunity than before to study the trees, and have been giving the children some lessons on the study of trees for several seasons, for the sake of teaching them in a general way the characteristics of the trees; that trees are not at all alike; that they have characteristic growth; and are a little different when young from what they are when old. Across the street, beyond the fence are old elms, and in the yard, young elms. They see relation between old and young, and with a little suggestion have learned why there are no lower branches on the elm trees. I found perhaps more strikingly illustrated than ever before, the fact that drawing does make them see better, because some wanted to make the tree fork too high or too low or spread apart too much after it had divided, and they made certain other mistakes. I tried two ways of making them draw; one by measuring and the other by judging roughly, which answers better than measuring exactly. At least I got better results with these young children.

I have evidence that certain results are being obtained; certainly that love of nature has been awakened, and observation quickened; they are seeing that things do not happen, and that things are not always what they seem at first sight; that nobody knows everything about anything; and they may find out more. Humane consideration for the lower forms of life is being strengthened. Instead of being afraid of spiders and caterpillars and other things which have been thought ugly, they find them interesting objects for study. I find, too, that it is of value when children come to the study of the high school sciences. They know better what is meant and do better work. I also find that the children who come into the higher grades of the intermediate department who have not had this work are very much at a disadvantage with the other children. There is no spirit in the class against the work, as there was. It may be partly due to my experience with younger children, but that is the fact.

We have been studying the cocoons of the spider this fall. I have not had time to mount the work in a way to let it be seen. We found them in great abundance on the sweet clover, and they looked a little like some cocoons we had before, except in shape. We opened them and found the egg masses within. In some were the young spiders, motionless, but, on stirring them, they moved about. We also found some of the empty eggshells, looking like white powder inside. Immediately after having seen some of the egg masses, the children concluded that they were the "skins" of the egg. Some thought at first that the hole in the top of the cocoon was for the young spiders to get out and come in. Another suggested it might be to give the spiders air, which was probably the case. This study is not yet finished, because we want to see what will happen by spring. Those deprived of their covering are not dead. I will show a few specimens of the work.

[Miss Hill exhibited specimens of the drawings made by the children and compositions written by them. The remainder of her talk was explanatory of the illustrations.]

Miss Bessie Dewitt Mershon—It is unfortunate that at this point the program must be changed from the informality of the last half hour to a written paper; but, fortunately or unfortunately as one chooses to think, I was brought up a "blue presbyterian" and so find it very difficult to collect my thoughts when before an audience of this kind.

My training for this nature work has been little so far as schools are concerned. During my school course I had one term's work in botany—just enough to let me peep into that great Book of Nature and make me want to know more. So ever since, I have been at work with botany, zoology and geology. My teacher for the greater part of the time has been Mother Nature; my lessons were the fields and meadows with the Book of Nature; my helps have been any book or paper I could find on the subject in hand; but none were so true as that great world-wide book.

My nature work teaching began in Springfield Mass., where the work was planned by our able supervisor, Miss Stebbins. I was fortunate enough to be able to go out a few times into the fields with Miss Stebbins, where she made me feel with Stevenson:

> The world is so full of a number of things,
> I'm sure we should all be as happy as kings.

Since coming to New York state, I have been studying under the direction of the home nature study bureau of Cornell; and, if I were able, I would beg, urge, yes and implore every teacher in the state to follow the same course, and I only wish it were possible for every one in this country to do so. It is well worth all the time and trouble, which to me meant nothing but writing down the answers, for the observations were carried on in the fields with the children, where children and teacher were alike learners.

As to the bringing of the work into the school, I can not speak strongly enough in its favor. But in order to make the work successful, as in everything else, it is necessary that the teacher enter into it with her whole heart, for, as an author has said, " The difference between half a heart and a whole heart makes just the difference between signal defeat and splendid victory."

Another great aid to my work has been that of having a junior naturalist club in my room. Oh, you teachers who have not tried to have such a club do not know what riches you are missing! No work is added to that of the teacher, but rather she receives much help, as the children like the idea of being members of a club; and then the leaflets which come each month to each child as well as the letters from " Uncle John " are looked forward to the whole month and are very helpful. My experience has been that the children's eyes are opened to the many beauties of nature which they had been passing almost daily unnoticed. Mrs Browning has written:

> Earth's crammed with heaven,
> And every common bush afire with God;
> But only he who *sees* takes off his shoes:
> The rest sit around it, and pluck blackberries.

If we teachers can lead the children to *see* one hundredth part of the beauties of nature, we may be happy. If we can only feel what Dr Payson said long ago to some teachers!

> What if God should place in your hand a diamond and tell you to inscribe on it a sentence which should be read at the last day, and shown there as an index of your own thoughts and feelings, what care, what caution would you exercise in the selection! Now this is what God has done. He has placed before you the immortal minds of your children, more imperishable than the diamond, on which you are to inscribe every day and hour, by your instructions, by your spirit, or by your example, something which will remain and be exhibited for or against you at the judgment.

If this be true—and I believe every word of it—what better can we do than lead these children intrusted to our care, to see the beauties of nature, and to observe some of its laws? Where can the idea of water partings, river basins and systems and the divisions of land and water be more easily taught than on some sloping ground during one of our thaws? We have had very enjoyable times when the pupils, after working with the sand table in the schoolroom, have gone out to a gentle slope near the school and with long sticks pointed out the various things. I have never found children getting cape and peninsula or isthmus and strait confused after a lesson of this kind. And oh, how they do enjoy the lesson!

At one time we had a glass fruit jar brought into the schoolroom. It was partly filled with soil from an ant hill with a number of ants. A thick brown paper was wrapped around the jar to keep it dark, and it was left for several days with a lump of loaf sugar on top of the ground. When we took off the paper, we found that work had been going on all the while. Two large halls were found close to the glass, leading from opposite sides of a room which was evidently the nursery, for in it were two pupa cases.

After this experience I found that the children no longer desired to kill the ants which they saw running over the walks. In fact, one active boy told me he had spent nearly two hours one Saturday morning watching some ants at work at one of their hills. I knew from what he told me that he had been thoroughly in earnest.

One morning last spring one of my boys came running up to our room, followed by about a dozen others. Everyone was looking troubled, and my boy was bareheaded. As soon as they reached the room, Charles asked very earnestly, "Can't I go back to Plant street and put this bird back in its nest?" I looked and saw that he had put the bird in his cap, so as to have it as comfortable as possible. I also saw that the bird was nearly dead, so asked him if he did not think he could put it into one of the trees near the school just as well. He looked up to me with an expression one could not possibly refuse and said, "But its mother is crying up there on Plant street." When he returned after putting the little one in its nest, his face showed that he felt,

> If I can stop one heart from breaking,
>   I shall not live in vain:
> If I can ease one life the aching
>   Or cool one pain,
> Or help one fainting robin
>   Unto its nest again,
> I shall not live in vain.

Dr Johnson said, "To cultivate kindness is a valuable part of the business of life." Another author has well said—what I think our nature work is doing:

> Man has one power in particular, which is not sufficiently dwelt on, it is the power of making the world happy or at least of so greatly diminishing the amount of unhappiness in it as to make quite a different world from that which it is at present. The power is called kindness. The worst kinds of unhappiness, as well as the greatest amount of it, come from our conduct to each other. If our conduct were under the control of kindness, it would be nearly the opposite of what it is, and so the state of the world would be almost reversed. We are for the most part unhappy because the world is an unkind world. But the world is only unkind for the lack of kindness in us units who compose it.

Hence we may conclude that "the child who is kind to animals will never forget his obligations to his fellow men."

Early last June we had a very happy surprise on opening an express package from "Uncle John" to find it contained a number of silkworms. We placed them in a terrarium made of wire netting, and two boys were delegated to go for the mulberry leaves each day. In a few days one of the caterpillars stopped eating, and in the morning we found a beautiful cocoon. The children were greatly excited as to what should be done with the silk. I heard them discussing it together before school, and finally one of them came to me and asked what I was going to do with the silk. I said that I had not yet decided, and then asked him what he would like to do with it. He said, "Oh, we all want you to have a silk waist out of it." I did not wish to throw cold water on such generosity, so I thanked them and said, "We will see about it." In a few days, after we had had some lessons on the silk cocoon, we unwound a part of one of them and then raveled out a very small piece of ribbon, and the children saw for themselves what I did not want to tell them, that to make a waist we should need many, many more cocoons than we had.

Our field lessons form one of the most enjoyable features of our work. When teacher and 48 pupils turn their backs on school and books and city streets to go forth into some wide field or woods, only those who have tried it know the feeling of freedom which comes over every one of the number.

One class which I had been teaching in the heart of a city, when first taken out into the fields, was very expressive of this feeling. As the first boy entered the field, he turned a somersault. He just had to, and quicker than it takes me to tell it every boy followed suit; some of them two or three times. I wondered, as I stood there watching and enjoying the performance, what an onlooker would think of my class and my control of it, but, thinking I knew my boys, I did not worry. As soon as they had thrown off the crowded city feeling, every boy stood with head up and feet down ready to look for the things we had gone to seek. That day we were to look for leaf-miners and galls, and we found that

There's never a leaf nor stem
Too lowly for these tiny creatures.

Another field lesson was to see how many different ways plants have of scattering seeds, and it was surprising to see the number of ways found, and oh! the shout of joy that went up when we came under a chestnut tree, the first frost of the season having come the night before. I was reminded of the little poem about the chestnuts, so the next morning had it written on the blackboard for the benefit of the children.

The chestnuts closed their purses tight,
But Jack Frost opened them all last night.
I think some time I'll sit up and see
When he opens the burs, if he won't show me,
For I've wondered so, and I wish I knew
Why he don't get pricked, as my fingers do,
And I can't see why, after all his fuss,
He leaves them here on the ground for us.

We have had toads, fishes, frogs, crickets, grasshoppers, caterpillars, etc. in our room, and I find that having them there is an aid in discipline. At one time I had a boy with an exceedingly quick temper; he would strike and say the most unkind things on the least provocation. One day he asked me if he might care for the fish. I said, "John, if you could keep your temper I would be glad to have you care for them; but you know those fish might not do just as you wanted them to, and then we might have a dead fish, a broken globe and worst of all an angry boy." He went back to his seat angry, but in a few minutes he came back smiling and said, "Miss M., if you'll let me care for the fish, I'll try to keep my temper." He cared for them from that time, and I am thankful to say he tried hard to keep his temper.

Another case where nature work has helped me was in the case of a boy who entered my room several weeks after school had begun. All over his face were written obstinacy, sullenness, ugliness and everything disagreeable. I watched him carefully without his knowing what I was doing and concluded that he had made up his mind he was a bad boy because every one expected him to be, so he would not disappoint them. On this conclusion, I thought perhaps I could reach him by asking him to help me clean the boards after school. Unfortunately I asked him before school was out, and he replied, "No, I don't want to." Though failing that time, I determined to keep on till I had found what that boy was interested in. In a few days I was rewarded during a nature lesson to find he had observed a number of things about the plants in our room which few others had seen. "Is this a clue?" I asked myself. It was a rainy day, and the entire school was working at a quiet lesson except Theodore, who showed by his every motion that he did not intend to write the lesson. Apparently I did not see his attitude, but went to him and whispered, "Theo, do you think you could carry the large fern down and put it in the rain without getting wet, yourself?" How the expression of his face changed! He was trusted to do an errand and to care for a *plant*, that which I afterward found was one of the dearest of things to him. Later on, when I gave out some seeds for them to plant at home, I found no one more interested than he, but it was a sort of secret between us. I think, if I had once spoken of it in any way before the class, he would have gone home and pulled up every plant, rather than have anyone else know that he cared. I can not tell anything more of this boy, as he moved away after being with us but two months. I was very sorry to have him leave.

There is nothing concerning which children will talk so freely as live creatures and plants, things which they can watch. In these talks how much a teacher may learn of that inner self which she may never otherwise see; and, now that our Bible is taken out of our schools, how are the children to learn of the Creator of all these things if not through the things which He has created? We are thankful indeed that, though the Book of Life has been taken from them, no one can take the Book of Nature.

When Earth's last picture is painted and the tubes are twisted and dried,
When the oldest colors have faded, and the youngest critic has died,
We shall rest, and faith, we shall need it—lie down for an eon or two,
Till the Master of all Good Workmen shall set us to work anew!

And those that were good shall be happy; they shall sit in a golden chair;
They shall splash at a ten league canvas with brushes of comet's hair;
They shall find real saints to draw from, Magdalene, Peter and Paul;
They shall work for an age at a sitting and never be tired at all!

And only the Master shall praise us, and only the Master shall blame,
And no one shall work for money, and no one shall work for fame;
But each for the joy of the working, and each in his separate star,
Shall draw the Thing as he sees it, for the God of Things as they Are.

Prin. R. J. Round—I have been asked to talk 10 minutes on nature study as it exists in Elmira. Several years ago, when I was principal of a grammar school in Elmira, we were required to observe Arbor day one day in every year, at which we had exercises; and, after we had observed the day for several years, it grew rather monotonous, the same subject recurring every year. I felt at that time if we could have greater latitude and take in not only trees but all kinds of plants and all kinds of life, in other words, if we might call the attention of the children to the life about them, it would be a good thing for the scholars. Just about that time the nature study work of the Junior Naturalists Club of Cornell University was started; and I felt that there was my opportunity, and I think that I was one of the first, certainly in Elmira, who availed themselves of that opportunity. We formed clubs, and we have done more or less work. In the schools of Elmira no work in nature study has ever been required in the course. It has been left optional with the principals, and the principals have largely left it with the teachers, so that the work has been necessarily very crude and fragmentary; but I imagine that most of us are in the same position. It is still in the experimental stage, though it has done a great deal of good. We have accomplished much, though our work has been unsatisfactory. At first we received the leaflets, and we gave as much attention as we could to them. We wrote the letters, and later we have been doing the work in the schoolroom. Last spring Miss McCloskey visited our schools. She brought with her a number of objects to show the children, and she talked to them about the monarch butterfly, which I suppose you know is on the Junior Naturalists' button. She described the green chrysalis with the gold nails; and, as I sat listening to her as she talked to a room full of children, I thought what a beautiful thing it would be if we could have this chrysalis in our room to show to the children. I never had seen the chrysalis of a butterfly. I had seen the cocoons of moths. Those are very common, and most of us have had them in our schoolrooms. I thought if we could only get such a thing as that to show the children, what an interest would be created. It was my privilege to attend the summer school at Chautauqua last summer and become a member of the class in nature study. While there, the larvae of the monarch butterfly were brought into the classroom; and we watched the chrysalides day by day till the butterflies emerged. I felt if I could go home and have that reproduced in our schoolroom it would be a great thing, but I had no idea whether I would succeed or not. I started out one Saturday morning with some of my boys to see if we could find some caterpillars on the milkweed. We found a great many milkweeds, but we did not find a caterpillar. On Monday I told the rest of the class that we had tried and that we had failed, and asked them if they would try. A day or two afterward some of the boys brought in some milkweed larvae with the milkweed, and we made a cage. We had a large glass jar, and we tied mosquito netting over the top. We had several of the cages, and the feeling spread to the other rooms, and in four different rooms we had the caterpillars of the monarch butterfly feeding. To make a long story short, the children watched those with great interest; and finally those caterpillars hung themselves up with the fishhook shape, as you who have seen them know, and the transformation took place, and the butterfly chrysalis with the gold nails was perfect. We had those in several rooms. We watched them with great interest till finally we were rewarded by having the butterflies come out.

Now, that was the realization of a dream, a dream that I had six months before when Miss McCloskey had been there and told us about these things. None of us had ever seen them. I had lived to be over 50 years old and had never seen such a thing, and yet with no difficulty we realized this dream. The pupils in the four highest grades, numbering 150, saw the metamorphosis. They saw everything except the eggs. We had none of the eggs. If we never do anything more in nature study for those pupils, we have accomplished a great deal; and I never expect to get more pleasure out of any school work than I did out of that experience. This is told as an illustration of what we can all do. I never had any special training in science, and I do not feel myself qualified to do this work; yet the children had the opportunity to observe closely and carefully a most wonderful thing in nature that is going on around us all the while.

We have these clubs in all of our grades of the school from the fourth to the eighth, inclusive. Each member of a club writes a letter a month to Mr Spencer. While the pupils were watching these changes, I assembled two of the classes every morning and for 15 or 20 minutes I talked and read to them about moths and butterflies. I simply made an illustration, made a type of the caterpillar, of the monarch butterfly. We had other caterpillars, and the cocoons were found in the schoolroom. We have had silkworms and the same experience spoken of by the last speaker. Mr Spencer asked us if we would like some of the caterpillars. I said yes, but I did not know how we could feed them. I did not know that there was a mulberry tree in the city of Elmira, but, on my inquiring of the children, they said, "Yes, there is a mulberry tree in the next yard". That is an illustration of what we can do if we try. We had the leaves brought in and the caterpillars or silkworms fed and the cocoons spun, and we kept them till the moths came out and laid their eggs. So we had the complete metamorphosis.

Of course, the changes took place slowly. The children observed and at the end of the month wrote their letters. In our grammar school conference yesterday, we discussed the subject of composition writing, and I have felt that the nature study work has been a great help to our pupils in the matter of composition writing; and you saw the work there in drawing. The nature study work is very helpful in drawing and composition. The children like to write if they have something to write about. Those of us who in our early days had to write compositions and did not know what to write about had great difficulty; but, if you give children every month some material to think about, and they work it up and take notes, when they come to write, they have something to say from their own experience.

Mention has been made of the excursions and the walks. We have done something of that. Last spring I went out with a number of my classes. Each took along a little basket and a little notebook and pencil. We went out into the woods and fields, and every bird that we saw we made a note of. Everything peculiar about it we noted; and then gathered the wild flowers, as many as we could, and brought them to the schoolroom the next morning. We put on the board lists of the birds we saw. The supervisor in drawing was around that morning and took advantage of the opportunity to give a lesson on drawing these wild flowers. The drawing teachers are ready to cooperate with us; they are glad of the opportunity it furnishes to create an interest in the drawing.

The greatest difficulty I find is this: teachers as a rule are willing and glad to do this work, but they can not do successful nature work without taking some time. They have to provide specimens. Every teacher can do it, I am sure, without any previous preparation. Of course, if a teacher's attention has been directed to the study of botany or of entomology or zoology, she is better prepared for it, but every teacher can find some subject in which the children can be interested. With our modern curriculum, with the multiplication of subjects, the grade teacher has difficulty in finding time. With a supervisor of drawing, music and physical culture, and with a principal who is not particularly interested in the nature study, it is hard for a teacher to get the time to spare. I have been interested in nature study, and my teachers have known it, and have been perhaps more willing to work than the teachers in a school where the principal is not particularly interested. Even in my school I have felt a hesitation in urging the teachers to do this nature study work. I do not know how we are going to solve the problem. Our state superintendent, in his last report, called attention to the fact, and this is not the first time he has done it, of the overcrowding of our courses of study; and he spoke of it in an address to the grammar school principals yesterday morning. I say I do not know how we are going to overcome this difficulty, but I do believe most thoroughly that, if the grade teachers could be given the time to make the preparation, and through all the grades some time of the week could be given to the subject of nature study, there would be a marked improvement not only in the moral character of the pupils, but in all the work done in our schools.

One thing has been a great comfort to me. Mrs Comstock gave utterance to this thought in the talks to the teachers at Chautauqua. She issued for the use of the teachers a syllabus, giving an outline for each grade for each season of the year. There is a great deal of work suggested, and that frightens the teachers. Mrs Comstock said this, and I have said the same thing to my teachers: Do not be afraid to take hold of this work because there is so much to be done. Look over the outline. You will find something there that you are interested in, and of which you have some knowledge; and if in the term you only get the children to study carefully and closely some one thing, you will have accomplished a great deal. I have carried out this thought and, as I told you, made a beginning in our study of the metamorphosis of the monarch butterfly. If we do not do anything more this year than that one thing, I feel that we have done a great deal for those children; and I believe every teacher can do as much. She can find some one object and bring the living creature, either plant or animal, into the room and watch the changes. Call attention to the details and get the children to describe them. That is a beginning, and that beginning we have made.

Saturday, 11.15 a. m.

GENERAL SESSION

A STANDARD COLLEGE ENTRANCE OPTION IN BOTANY

COMMITTEE REPORT[1]

PRESENTED BY PROF. FRANCIS E. LLOYD, TEACHERS COLLEGE, COLUMBIA UNIVERSITY

1 It is founded on the two important reports of the National Educational Association, the report of the Committee of Ten (Washington 1893), and the report on college entrance requirements (Chicago 1899).

2 It is intended primarily as an option for entrance to college, but equally for the education in the high school of the general student who can follow the subject no farther; there are in

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[1] The committee was appointed by the Society of Plant Morphology and Physiology.

botany no advantages in having the college preparatory and the general educational courses different, at least none that are at all commensurate with the additional burden thus laid on the schools.

3 It should, if possible, be founded on a considerable body of botanical fact learned through "nature study" in the lower schools; it should form part of a four years high school course in the sciences; it should be considered and treated as an elementary or preliminary course leading to second courses in colleges, and colleges accepting the option should make provision to articulate second courses economically with it.

4 The immediate plan of its construction is very simple, namely, to include those topics in the leading divisions of the subject which most teachers now regard as fundamental, either for their value in scientific training, or as knowledge; but the individual teacher is left free to follow his own judgment as to sequence of topics, text and other books and special methods. Advice is occasionally offered, however, on important points in which most teachers are now known to agree.

5 It is designed to yield a mental discipline fully equal in quality and quantity to that yielded by the older subjects studied for the same length of time.

6 The time per week, inclusive of recitation, preparation, and laboratory, should be the same as for any other subject. Where five periods a week with an hour of preparation for each are demanded for other studies, this course should receive the equivalent of two recitation periods with their preparation, together with three double (not six separated) periods in the laboratory and a small amount of outside related work or preparation. Variation from this should be toward a greater, not a lesser proportion of laboratory work.

7 The preparation of records of the laboratory work, in which stress is laid on diagrammatically accurate drawing and precise and expressive description, is regarded as an integral part of the course; and these records, preferably in a notebook, must be presented with the examination paper, and will count one third toward admission.

8 There must be provided

- *a* A full year option
- *b* A half year option
- *c* The possibility of a two year option

Specifications

The full year option, to count as 1 unit or point out of 13 to 15 for entrance, will consist of:

1 A half year devoted to the general principles of anatomy, morphology, physiology and ecology.

2 A half year devoted to the natural history of the plant groups, with classification.

Under special circumstances, though it is not advised, the full year option may consist of 2 enlarged to occupy a year and including the essentials of 1.

The half year option, to count as 1 unit or point out of 26 to 30 for entrance, may consist of either 1 or 2 above, but not of a composite of both.

A half year option consisting of a composite of 1 and 2, though recognized as profitable under some local conditions, is not here included; since, while it is not considered educationally superior, if equal, to 1 or 2 more throughly studied, it will be impossible for colleges to make arrangements to articulate it profitably with their higher courses in addition to 1 and 2; and, moreover, examination boards will find obvious difficulties in providing examinations for it.

The two years option will consist of 1 enlarged to a year, together with 2 enlarged to a year.

1 The half year option in the general principles of anatomy, morphology, physiology and ecology

The fundamental topics are the following:

a In anatomy and morphology

The seed. Four types (dicotyledon without and with endosperm, a monocotyledon and a gymnosperm); structure and homologous parts.

Food supply; experimental determination of its nature and value. Phenomena of germination and growth of embryo into a seedling (including bursting from the seed, assumption of position and unfolding of parts).

The shoot. Gross anatomy of a typical shoot; the arrangement of leaves and buds on the stem, and deviations (through light adjustment etc.) from symmetry.

Buds, and the mode of origin of new leaf and stem; winter buds in particular.

Specialized and metamorphosed shoots (stems and leaves).

General structure and distribution of the leading tissues of the shoot; annual growth; shedding of bark and leaves.

The root. Gross anatomy of a typical root; position and origin of secondary roots; hair zone, cap and growing point; origin of new roots.

Specialized and metamorphosed roots. General structure and distribution of the leading tissues of the root.

The flower. Structure of a typical flower, specially of ovule and pollen; nectar glands; functions of the parts. Comparative morphologic study of six or more different marked types, with the construction of transverse and longitudinal diagrams.

The fruit. Structure of a typical fruit, specially with reference to changes from the flower, and from ovule to seed. Comparative morphologic study of six or more marked types, with diagrams.

Where options 1 and 2 are combined to form a year course, this comparative morphologic study of flowers and fruits may advantageously be postponed to the end of 2, and then taken up in connection with classification of the angiosperms.

The cell. Cytoplasm, nucleus, sap cavity, wall. Adaptive modifications of walls, formation of tissues.

The sequence of topics above given, with the exception of the position of the cell, is that recommended by the committee, but the precise sequence is not considered important.

As to the study of the cell, it is by no means to be postponed for consideration by itself after the other topics, as its position in the above outline may seem to imply, but it is to be brought in earlier along with the study of the shoot or root, and continued from topic to topic. Though enough study of the individual cell is to be made to give an idea of its structure (a study which may very advantageously be associated with the physiologic topics first mentioned under *b*) the principal microscopic work should consist in the recognition and study of the distribution of the leading tissues.

b In physiology

Rôle of water in the plant; *absorption (osmosis), path of transfer, transpiration, turgidity and its mechanical value, plasmolysis.*

Photosynthesis; *dependence of starch formation on chlorophyl, light and carbon dioxid; evolution of oxygen,* observation of starch grains.

Respiration; *necessity for oxygen in growth, evolution of carbon dioxid.*

Digestion; *digestion of starch with diastase,* and the role of digestion in translocation of foods.

Irritability; *geotropism, heliotropism* and *hydrotropism;* nature of stimulus and response.

Growth; *localization in higher plants; amount in germinating seeds, and stems; relationships to temperature.*

Fertilization; sexual and vegetative reproduction.

Though for convenience of reference, the physiologic topics are here grouped together, they should by no means be studied by themselves and apart from anatomy and morphology. On the contrary, they should be taken up along with the study of the structures in which the processes occur, and which they help to explain; thus, photosynthesis should be studied with the leaf, as should also transpiration, while digestion may best come with germination, osmotic absorption with the root, and so on. The student should either try, or at least aid in trying, experiments to demonstrate the fundamental processes underlined above.

c In ecology

Modifications (metamorphoses) of parts for special functions.

Dissemination.

Cross-pollination.

Light relations of green tissues; leaf mosaics.

(Plant societies; mesophytes, hydrophytes, halophytes, xerophytes; climbers, epiphytes, parasites (and saprophytes), Insectivora. Symbiosis)

(Plant associations, and zonal distribution)

The topics in ecology, (particularly the first four and in part the fifth) like those in physiology, are to be studied not by themselves, but along with, and in dependence on, the structures with which they are most closely connected, as cross-pollination with the flower, dissemination with the seed, etc. The fifth and sixth may most advantageously be studied with *g* in part 2, and are to be considered as recommended rather than as required.

In this connection field work is of great importance, and for some topics, such as the sixth, is indispensable, though much may be done also with potted plants in greenhouses, photographs, and museum specimens. The committee strongly recommends that some systematic field work be considered as an integral part of the course, coordinate in definiteness and value as far as it goes with the laboratory work. The temptations to haziness and guessing in ecology must be combated.

2 The half year option in the natural history of the plant groups, and classification

A comprehensive summary of the great natural groups of plants, based on the thorough study of the structure, reproduction and adaptations to habitat of types from each group, supplemented by more rapid study of other forms in those groups. Where living material is wanting, some use may be made of preserved or even pictured materials. A standard textbook should be carefully read. The general homologies from group to group should be noted.

In general, in this part of the course, it is recommended that much less attention be given to the lower, difficult and inconspicuous groups, and progressively more to the higher and conspicuous forms, and that at least one third of the time devoted to the groups be given to the spermatophytes. Attention should be called throughout to the economics (relation to man's good and injury) of the forms and groups studied.

Following is a list of recommended types from which selection may be made.

a Algae. Pleurococcus (or Sphaerella), Spirogyra, Vaucheria, Fucus, Nemalion (or Batrachospermum or Polysiphonia or Coleochaete).

b Fungi. Bacteria, Rhizopus, yeast, Puccinia (or any powdery mildew), mushroom.

Bacteria and yeast have obvious disadvantages in such a course, but their great economic prominence may justify their introduction.

c Lichens. Physcia (or Parmelia).

d Bryophytes. In Hepaticae, Radula (or Porella or Marchantia). In Musci, Mnium (or Funaria or Polytrichum).

e Pteridophytes. In Filicineae, Aspidium or equivalent, including of course the prothallus.

In Equisetineae, Equisetum.

In Lycopodineae, Lycopodium and Selaginella (or Isoetes).

f Gymnosperms. Pinus or equivalent.

g Angiosperms. A monocotyledon and a dicotyledon, to be studied with reference to the homologies of their parts with those in the above groups; together with representative plants of the leading subdivisions and principal families of angiosperms.

Classification should include a study of the primary subdivisions of the above groups, based on the comparison of the types with other (preferably) living or preserved material. The principal subdivisions of the spermatophytes, grouped on the Engler and Prantl plan, should be understood.

The ability to use manuals for the determination of the species of flowering plants is not considered essential in this course, though it is desirable. It should not be introduced to the exclusion of any other work, but may well be made voluntary work for those showing a taste for it. It should not be limited to learning names of plants, but should be made a study in the plan of classification as well.

The preparation of a herbarium is not required or recommended except as voluntary work for those with a taste for collecting. If made, it should not constitute a simple accumulation of species, but should represent some distinct idea of plant associations, of morphology, of representation of the groups, etc.

SYMPOSIUM

WHAT OUGHT THE HIGH SCHOOL TEACHER IN EACH SCIENCE TO KNOW? WHAT OUGHT HE TO BE ABLE TO DO? WHAT ARE HIS OPPORTUNITIES FOR SELF-IMPROVEMENT?

Prof. Lyman C. Newell—What I shall say will be confined to the last of the three questions to be discussed in this symposium. The third question, "What are his opportunities for self-improvement?" is important, because it presents so many practical aspects. Perhaps the largest opportunity is access to periodical literature. Magazines devoted to every branch of science are numerous, and no progressive teacher can afford to lose sight of them. It is not always possible to read and digest an article as soon as it appears. Therefore teachers must have some plan of keeping track of helpful articles. Those who have never tried to do this may regard it as an almost impossible operation, but I have not found it so. An hour a month I have found sufficient to enable me to record on cards, about half the size of an ordinary library catalogue card, the title, etc., of all articles in current magazines which I believe will be helpful. As soon as convenient I read the articles, abstract what seems advisable, or, as often happens, purchase the magazine and file it away for future use. The cards are filed alphabetically by topics, the simplest word being placed first, though the exact title is always put on the card. Some such plan is necessary if one is to prepare papers and to keep track of discoveries and the progress of principles. I recommend the card system after a trial of nearly 10 years.

A second opportunity for improvement is general reading, specially in one's special field. Teaching is apt to make one narrow. Our daily work does not open many different channels of thought and interest. Many teachers are deplorably uninformed in the different branches of their subject. So important is this matter in the opinion of the New England Association of Chemistry Teachers that a list of books in chemistry has been prepared by them. This list is dévoted to the needs of secondary teachers, though others will find it useful. I have brought a number of copies of this list, and they are at your disposal. Additional copies may be obtained of the L. E. Knott Apparatus Co., 16 Ashburton place, Boston Mass. Many books have recently appeared on new subjects which will soon be taught in the secondary schools, and now is the time for teachers to acquaint themselves with the general outlines of these subjects. This is specially true of physical chemistry and electrochemistry. Several books on these subjects are described in the list just mentioned. In addition to the use of printed lists, teachers should not fail to improve themselves by examining new books as soon as they appear. Many hints are obtained from them. In this connection it may be well to state that teachers should keep track of good books. One's circumstances often change; a book not available in one place may be needed elsewhere. To be a serviceable teacher, one must be prepared to adapt one's self readily to new conditions.

A third means of improvement is illustrated by this very meeting. It has been an inspiration to me to meet teachers who are working in the same line as I, though under different circumstances. In New England we have two science associations, one devoted to chemistry and one to physics. Each has a large membership, and is a source of profit and pleasure to the members. We give and take freely. No one attempts to take without giving in return. The records of the meetings are published in full and are freely distributed.

These three contemporary opportunities for self-improvement may be utilized without adding to our daily burdens, and in time they may become part of our literary recreation.

Prof. Henry R. Linville—I wish to speak of what seems to me to be the difference in value as teachers between the man who has had the conventional college course and the one who has done postgraduate work in a university. If it were possible to find two men of the same capacity, physically and mentally, that could be subjected to the same training up to a certain point, and led into different work after that, I am confident that a practical demonstration of the benefit of thorough work in the best graduate schools could be made. As things are, the comparisons that occur to anyone who thinks on this question are convincing. All of us are familiar with the average college graduate who in the first year after receiving his degree begins his career of teaching. He finds difficulties and in time overcomes them to the satisfaction of himself, his principal and the board. With 10 years of this experience he has made a place for himself in the list of steady and reliable teachers. This man can teach a class in Latin as well as in English or in mathematics, and all of them successfully in a place where the scholar's ideal of good teaching is not likely to be prevalent. Secondary schools are filled with this sort of men, and their presence is responsible for much of the mediocre, humdrum, spiritless work found in these places.

A man who pursues a consistent course of investigation in some special field is being trained (within the limits of his native ability) into the possession of one of the greatest powers of the human mind—the power of independent and accurate judgment. Such a man, with a natural capacity for teaching, can become an immediate force in any institution. He is an abler man than he would have been without his special training. The manifestation of his ability need not be limited to any particular line of work. His judgment has been trained, and the trained judgment may be used in various directions. The teaching of this sort of man has every reason for being characterized by high quality, spirit and inspiration.

When a teacher regards with thorough and intelligent respect the principles of his science, he is undoubtedly in a position to inspire a similar respect for the science in the minds of his pupils. This is the ultimate proof of success.

Saturday afternoon

GENERAL SESSION

STIMULANTS AND NARCOTICS

REPORT OF PROGRESS OF THE COMMITTEE

PRESENTED BY PROF. IRVING P. BISHOP

At the meeting of this association held in New York in 1898 the attention of the council was called to certain discrepancies between the facts of physiology taught in the universities and medical schools and those taught in the public schools of the state. As the result of the discussion which followed, a committee of five was appointed "to ascertain and report what is definitely known regarding the effects of alcohol and narcotics on the human body and to recommend suitable methods for teaching the same in the schools of the state." A careful examination of the bibliography of alcohol alone revealed an enormous mass of matter, and a wide difference of statement on almost every point, even among those best qualified to know. As it was known that the Committee of 50 for the Investigation of the Drink Problem, a nonpartizan organization, was conducting original researches, your committee unanimously decided to defer its final report till the material from that source should be available. Recent correspondence with that body shows that the report of the subcommittee on the physiologic and pathologic aspect of the drink problem is now ready, and that it will be in our hands soon. We present, therefore, certain features of our work which show the progress made to date.

Comparison of textbooks used in medical colleges and in the public schools of the state

To illustrate the discrepancies referred to in the opening lines of this report, we subjoin parallel quotations taken from textbooks used in the medical schools and universities and there considered standard and those in general use in the public schools of the state. With one exception—Hutchinson's—the latter are indorsed by the Women's Christian Temperance Union.[1]

STANDARD TEXTS	SCHOOL TEXTS
It may, perhaps, be said with safety that in small quantities it (alcohol) is beneficial, or at least not injurious barring the danger of acquiring the alcohol habit, while in large quantities it is directly injurious to various tissues.[2] In practice we find that in many persons a small quantity of alcohol improves digestion; and that by its means a meal can be digested which otherwise would be undigested and so wasted.[3] In attempting fairly to estimate the action of stimulants, especially of alcohol, one point is of the utmost importance to remember. It is this—alcohol is a food. If alcoholic stimulants were mere disengagers of static force, early exhaustion would be the rule. But as alcohol is a readily oxidizable form of hydrocarbon, it is also a	Alcohol is not a food or drink. Medical writers, without exception, class alcohol as a poison.[4] Alcohol is universally ranked among poisons by physiologists, chemists, physicians, toxicologists, and all who have experimented, studied and written upon the subject, and who, therefore, best understand it.[5] Alcohol also is a poison. It deprives the bones of some of their food, and leaves in place of it, a mineral that makes them more brittle.[6] As alcohol is a poison, it should not be taken into the stomach. What is a poison? Anything is a poison that harms the body and makes one sick. Alcohol does both.[7] "Is alcohol a food?" "What do you think about it? (question to the class)—Do you

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[1] A part of the following quotations is taken from the advance sheets of the *Report on the Present Instruction in the Physiological Action of Alcohol* of the subcommittee of the Committee of 50 for the Investigation of the Drink Problem. Dr H. P. Bowditch, Prof. C. F. Hodge.

[2] Howell. Amer. Textbook of Physiology. Ed. 2. 1900. p. 359.

[3] Fothergill. The Practitioner's Handbook of Treatment. Lond. and N. Y. 1897. p. 688.

[4] Eclectic, no. 3, p. 5-7.

[5] Quoted from Youmans in Blaisdell's no. 2, p. 232.

[6] Hutchinson. Our Wonderful Bodies, First Book, p. 24.

[7] Hutchinson. First Book, p. 46.

food as well as a stimulant. In fact it is one of the most easily assimilable forms of food, and very frequently it can be taken and utilized when no other form of food is available. While it is a stimulant, an evoker of force, it also supplies to some extent that force in its readily oxidizable self. The experiments of the late Dr Anstie, and Dr Dupré have placed beyond all question or honest doubt the fact of the oxidization of alcohol within the organism. If alcohol is oxidized in the body, then alcohol is a true food, or furnisher of force.[1]

The question of the propriety of the daily use of alcohol by healthy men is at present a very serious one, involving so many moral and politico-moral issues that it can not be fully discussed here. Suffice it to state as obvious inferences from our present knowledge of the physiological action of alcohol, that the habitual use of moderate amounts of alcohol does no harm; that to a certain extent it is capable of replacing ordinary food, so that if it be scanty, or even if it be coarse and not easily digested, alcohol in some form or other, is of great advantage; that in all cases it should be taken well diluted, so as not to irritate the stomach; and that wine or malt liquors are certainly preferable to spirit.

As Liebig also found that this substance exists in the urine of dogs, horses and lions, and as A. Rajowski obtained it from healthy rabbits, it must be acknowledged that our present knowledge strongly indicates that it is formed and exists in the normal organism.[2]

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[1] Fothergill. Practitioner's Handbook of Treatment. Ed. 11. Lond. 1897. p. 254.

[2] Wood, H. C. Therapeutics, p. 372.

think your body would grow and keep well and strong if you used it instead of bread and meat?"

"No, indeed We know that alcohol is not a food."[3]

It is important for you to remember that alcohol is a narcotic poison.[4]

This alcohol is a liquid poison. A little of it will harm any one who drinks it, and much of it would kill the drinker.[5]

It must be remembered that in whatever quantity, or wherever alcohol is found, its nature is the same. It is not only a poison but a narcotic poison.[6]

Alcohol a Poison.

A poison is any substance whose nature it is, when taken into the body either in small or large quantities, to injure health or destroy life.

In large doses, in its pure state, or when diluted as in brandy, whiskey, rum or gin, alcohol is often fatal to life. Deaths of men, women and children from poisonous doses of this drug are common.

In smaller quantities, or in lighter liquors, beer, wine and cider, when used as a beverage, it injures the health in proportion to the amount taken.[7]

If on the other hand, you take into your stomach a little alcohol, it receives no such welcome. Nature treats it as a poison and seeks to rid herself of the intruder as soon as possible. Every organ of elimination, all the scavengers of the body—the lungs, the kidneys, the perspiration glands, at once set to work to throw off the enemy. The alcohol thus eliminated is entirely unchanged. It can not then be treated as an aliment or food.[8]

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[3] Health Series, no. 1, p. 30 ff.

[4] Eclectic Series, no. 2, p. 31.

[5] Pathfinder Series, no. 1, p. 41.

[6] Authorized Series, no. 8, p. 58.

[7] Dulaney's Series, no. 2, p. 46 ff.

[8] Steele's Hygienic Physiology. 1884. p. 164.

Conflicting statements like the above could be multiplied far beyond the limits of this report, but enough have been given to show that, in the interpretation of facts, there is a lack of concord which is no longer tolerable.

Opinions of the committee regarding the effects of alcohol

In attempting to select from the material at their disposal such facts as might be safely taught, your committee has endeavored to weigh evidence carefully. When possible, it has availed itself of the latest research, placing much confidence in experimental inquiry where it has been carried on with due care and regard for accuracy. That there may be no misunderstanding as to the meaning of terms, the following provisional definitions have been adopted:

Stimulant. An agent which temporarily quickens some functional or trophic process. It may act directly on the tissue concerned, or may excite the nerves which effect the process, or paralyze the nerves which inhibit it. Stimulants comprise certain medicinal substances, as ammonia, alcohol and ethylic ether, as well as physical conditions such as warmth, cold, light, or electricity, esthetic effects, as music and other products of art, and emotions of various kinds, as joy, hope, etc. Stimulants have been divided into general and topical, according as they affect directly or indirectly the whole system or only a particular part. *Century Dictionary.*

Narcotic. An agent which directly induces sleep, blunts the senses, and in large amounts produces complete insensibility.

Poison. A substance which when introduced into the body causes disease or death.

Regarding the influence of quantity in producing toxic effects there is much controversy. One class of physiologists take the view that alcohol in any quantity is a poison, and the other, while freely admitting that pure alcohol or even strong alcohol, in large doses, may produce poisonous effects, believe that in small or moderate doses it is harmless or positively beneficial.

The former view is exemplified by the following extracts:

"Alcohol is a true narcotic even in small doses."[1]

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[1] W. S. Hall. Elementary Anatomy, Physiology and Hygiene. 1900. p. 118. (Indorsed by W. C. T. U.)

"Alcohol is a poison of the narcotic class with a special tendency to act on the brain and nervous system."[1]

"There are no dividing lines on one side of which the poisonous action of alcohol can be seen, while on the other it is absent."[1]

"It is a scientific absurdity to assume that alcohol or any other substance is not a poison in small quantities but it is in large quantities."[2]

This view, however, is not that generally held by physicians and the authors of standard texts, who, with few exceptions, discriminate between the effects of large and small doses. For example, the *American Textbook of Physiology* says (p. 359): "The effect of alcohol upon the body evidently varies greatly with the quantity used." Indeed it seems probable that the effects of a drug may differ not only in degree but in kind. Prussic acid is a very deadly poison, and yet nature has put it into fruits which we consume not only with pleasure but also with impunity. The same may be said of oxalic acid, citric acid, etc. Even common salt may act as an emetic. Sound, light, heat and electricity furnish similar illustrations. In the judgment of your committee the same principle applies in the case of alcohol. While undoubtedly poisonous in concentrated form or in large quantities, it is apparently not so to adults when it is taken in small quantities and sufficiently diluted.

In attempting to decide what facts regarding the use of alcohol and its effects on the body may be safely taught, your committee has encountered an array of conflicting evidence which is extremely perplexing. There are very few points on which there is absolute agreement; in some cases the statements regarding the same topic are diametrically opposed.

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[1] "Alcohol as a Causative Factor in Disease of the Central Nervous System," T. D. Crothers M. D. Reprint from Journal of the Amer. Medical Ass'n. Ap. 9, 1898. p. 2 and 7.

[2] From a letter to the committee dated Dec. 18, 1901, signed by the three members of the special committee of the Onondaga co. Woman's Christian Temperance Union.

In view, also, of the probability that the report of the Committee of 50 for the Investigation of the Drink Problem will be published during the coming year, your committee has decided to postpone till the next meeting of this association its conclusions as to the action of alcohol on the various organs.

But, in order that there may be no misapprehension as to the convictions of the committee on certain practical points of supreme importance, we submit the following opinions and recommendations.

1 All writers agree that an excess of alcohol impairs certain functions of the cerebrum, for example, attention, memory and self-control, and that many cases of insanity are due to such excess.

2 What constitutes excess will differ with individuals, with occupations and with other conditions. On the present occasion your committee does not undertake to prescribe the limit of safety for the average adult.

3 The committee does not consider that the stimulative action of alcohol on the system as a whole has been demonstrated, nor is it aware that any authority claims that in health or under ordinary circumstances, alcohol is an *economical* food, whether for the production of heat or for the protection of fat or proteid.

4 As a matter of fact, the average man in health and under ordinary circumstances disregards these possible rôles of alcohol and takes it because of its flavor or because he finds it conducive to his personal comfort or to good-fellowship.

5 Your committee believes that *spirits* should never be used as beverages unless largely diluted, and that alcohol in any form should be taken only at meals and after the work of the day is done.

6 Youths, say under 21, should abstain altogether from alcohol, excepting under specific medical advice.[1]

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[1] The importance of this matter and the natural indisposition of youths to refrain from what is permitted their elders lead the committee to state the grounds of their recommendation categorically as follows:

1 Most parents prefer that their sons should abstain till of age.

2 Several college presidents have advised their students to abstain.

Opinions of educators on the present methods of teaching physiology

During the past year there have been conducted three separate inquiries, viz: (1) by the chairman of the committee; (2) by the chairman in conjunction with F. N. Jewett of the Fredonia (N. Y.) Normal School; (3) by J. E. Peabody as chairman of the subcommittee on teaching.

1 For the purpose of ascertaining the present status of physiology teaching in the state, circular letters of inquiry were mailed by the chairman of the committee to 450 teachers, the

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3 Among those who hold very liberal views as to the use of wine by adults, an experienced physician and an expert investigator of the whole subject wrote, respectively, as follows: "I exhort all young people in health not to adopt the practice of drinking wine." *Dr James Jackson* "For youths, say under 25, the proper rule is either no alcohol or very little indeed." *F. E. Anstie*

4 Analogous restrictions based on age are commonly recognized. The infant takes no solid food; the child retires early; the boy is spared severe labor; the responsibilities of marriage, of society and of political life are postponed till a certain development of body and mind has been attained. Is it not then prudent for the youth to defer the use of so potent an agent as alcohol at least till his majority is reached?

5 Seldom, if ever, is there at the outset a real liking for the taste of alcoholic beverages; on the contrary, their use is commonly begun in thoughtless imitation of older persons or of foreigners; an unworthy motive for doing anything of doubtful utility.

6 Comparatively few students live at home or take their meals at private clubs. At school and college boarding tables alcoholic beverages are seldom served; consequently they are likely to be used, if at all, at saloons, where the other conditions are more or less undesirable, and with little or no accompanying food. It is universally admitted that both the local and the general effects of alcohol are most pronounced when taken on an empty stomach.

7 To gain or hold places on athletic teams abstinence is generally required. Even German corps students are beginning to recognize the incompatibility of excessive beer drinking with proficiency in fencing.

8 The foundations of inebriety are commonly laid early. C. L. Dana found that of 210 inebriates nearly all began to drink before 30, and about two thirds before 20. *Medical Record*, July 27, 1901; *Quarterly Jour. of Inebriety*, Oct. 1901.

9 Youth is the age of peril; temptations abound without; appetites and passions are foes within; of all periods of life, in this should a man be ever "on guard," and protected by the community.

10 Habits are most readily and firmly established in youth. Of all the most valuable is the habit of self-control. "The world belongs to those who can control themselves"; but the man who uses alcohol in excess never can do that.

greater part of whom exercise some supervisory function and for that reason were supposed to have superior opportunities for knowing actual conditions. To avoid, as far as possible, a preponderance of local sentiment, these circulars were distributed over the entire state in cities, towns and villages of 1000 or more inhabitants. Of these circulars 203 were filled out more or less completely and returned. The replies are classified as follows:

Union and high school principals	106
City superintendents	32
Village superintendents (villages of more than 5000 pop.).	14
City grammar school principals	22
Special teachers of physiology	17
Normal school principals	7
Grade teachers	5
Total	203

For convenience, the questions and analyses of answers will be stated together.

Question 1 Do you regard as excessive the time now required by law for the study of physiology?

To this 139 or 68% answered "yes" and 63 or 31% answered "no."

Question 2 If excessive, would you change by decreasing subject-matter, or by limiting instruction to fewer grades?

Of the 126 answers, 100 or 79% were in favor of limiting instruction to fewer grades, five would decrease subject-matter, and 21 would do both.

Question 3 In the latter case, to what grades (school years) would you confine it?

To this 120 answers were received. Of this number 40 would begin work below the 6th year, and 80, or two thirds, would begin at the 6th grade or above. Of the latter division, 34 would begin at the 6th grade, 18 at the 7th, 18 at the 8th, nine at the 9th, one at the high school.

There were also some who preferred confining the work to a shorter time than four years. As a rule these were from the teachers who believe in teaching the subject as a science only, and in the higher grades or high school.

Question 4 In which school year should a textbook in physiology be first put into the pupil's hands?

Answers: 1st year, one; 2d year, one; 3d year, four; 4th year, 11; 5th year, 26; 6th year, 35; 7th year, 35; 8th year, 28; 9th year, six; 8th, 9th or high school, seven.

The reason given for not wishing to introduce a book earlier than the year chosen was in 38 instances, immaturity of the pupil; in six instances, difficulty of maintaining interest for so many years; and in four instances the belief that other work was of more importance. It is worthy of note that 80% of those answering preferred to begin the use of text in the grades included between the 4th and the 9th.[1]

Question 5 After having studied physiology through the grades, does the pupil now enter the high school with increased or diminished interest in the subject?

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[1] To ascertain how the point of view affected the answers, an analysis was made of the replies to the foregoing questions from superintendents, grammar school teachers and special physiology teachers. Of the 46 city and village superintendents, 64% answered "yes" to the first question. Out of their 28 replies to question 3, 64% wished to confine the work to grades above the 5th, and also to introduce the text at the 6th or some higher grade. The city grammar school principals showed a marked preference for physiology, eight voting "yes" and 14 "no" to question 1. Of the eight who replied to question 3, six were in favor of confining the work to the grades above the 5th. Of the whole number, 22, 72%, either did not answer the third question or would teach the subject in all grades. In answer to question 4, 10 of the 22 would first introduce a textbook above the 5th grade. Of the special teachers of physiology, seven would make of it a high school study, while one would confine it to college.

From the above it will be seen that the attitude of the city superintendents toward these questions does not differ widely from that of the whole group of teachers under consideration. That the grammar school men should favor physiology throughout the whole course to a greater degree than the other groups is a noteworthy fact. It would be interesting to know whether the preference is due to the change which a new subject gives to the routine of grammar school studies or whether the principal sees, in his closer relation to the pupils coming from all ranks of life, a greater usefulness in teaching pupils to abstain from tobacco and alcohol.

128, or nearly 63%, replied that the interest was diminished; 35 had noticed increased interest, and 13 more were doubtful. The reasons for diminished interest were not usually assigned. In 11 cases, weariness of the subject due to repetition was given as the cause; in three instances, disgust; and in nine the fault was laid on the teacher. One high school teacher of physiology preferred pupils who had not previously studied the subject to those who had; another said the pupils who studied in the high school alone passed the Regents examination in the same time and with as high marks as those who had taken the regular physiology work through the grades before entering the high school.

Question 6 What beneficial results do you observe in your school or community through the teaching of the effects of stimulants and narcotics?

To this question, 177 answers were given. Of this number 23 expressed doubt, 28 had seen beneficial results, and 120, or 62%, had noticed no effect whatever. The beneficial results were stated to be better habits or a healthy sentiment in favor of abstinence from the use of alcohol or tobacco. One principal said that not a single boy in his high school smoked or used alcoholic drinks. Five more gave a qualified answer, saying the results were beneficial under certain conditions. One was noncommital but said that the two breweries of his town were still doing business.

Question 7 Do you observe any detrimental results from the same cause?

132 answered "no" to this question, 13 gave instances where boys had experimented with tobacco or alcohol, either out of curiosity to learn its properties or a desire to "spite the teacher". It was believed that this action would not have been taken had not the study of the book suggested it. Another reason given by several was that the teaching in school was contrary to the child's own experience. "Many parents of children in my district", writes one ward principal, "drink moderately but regularly, and it is impossible to convince such pupils that

the use of alcoholic liquors is harmful ". Waste of time, weariness on the part of pupil, disgust, loss of interest, false ideas regarding stimulants and narcotics, formed an aggregate of 18 additional cases where the results were considered bad.

Taken together, the answers to questions 6 and 7 do not show as marked results as might fairly be expected from a study which has been a compulsory part of the education of every school child in the state for five or more years. On the other hand, there is now no means of knowing how far or in what direction the teaching now in progress may affect the future character of the child.

The present system is based on the idea that, if the child knows what is bad for him physically, he will avoid it. The evidence shows that this is not always so. A prominent teacher writes: "A cigarette fiend won the last W. C. T. U. prize in our school for an essay showing the effects of tobacco. He still keeps on using cigarettes."

Question 8 What textbook do you use? Is it satisfactory? Why?

To this 113 answered "yes", 26 "fairly", 38 "no" and 18 "not entirely." The feeling expressed was in the main favorable, indicating that the book answered the purpose for which it was designed. "Satisfactory," "As good as the law allows," "Complies with the law," "Meets the Regents' requirements," are answers needing no comment. Some of the juvenile books were severely criticized. "Wishy-washy," "goody-goody" and "nothing in it" were descriptions applied by three out of five teachers using one particular series. Several objected to the treatment of stimulants and narcotics as given in the texts, and others said they could teach the subject better without a book.

Question 9 Do you look favorably or unfavorably on the use of highly colored pictures illustrating morbid physiologic conditions?

The answers to this were, "unfavorably," 126; "favorably," nine; favorably with qualifications, six. "They give exaggerated and false impressions," "They create morbid tendencies," "Only normal types should be shown to children," "Sensational," "Unpsychological," "Vice is a monster," etc., express the general trend of opinion regarding this means of illustration.

Question 10 What changes, if any, would, in your opinion, improve the present system of teaching physiology?

The changes suggested showed a wide range of opinion. 12 teachers would leave the questions of quantity of matter and methods of presentation to the teacher, to the local authorities, to the Regents or to the superintendent of public instruction. 18 were in favor of putting the subject on the same basis as other studies. 52 would concentrate the time on fewer grades, making the work oral and hygienic below the sixth year. There was also a tendency in this group to emphasize hygiene and to do less with the topics of stimulants and narcotics.

2 A joint inquiry was conducted by F. N. Jewett and I. P. Bishop with the physiology classes in the Fredonia and Buffalo normal schools to ascertain if possible what the pupils had gained from previous study and what was their attitude toward the subject.[1]

The two classes aggregated 74 pupils, all above the age of 17. Their work includes both subject-matter and method of teaching.

Question 1 How many have studied physiology through the grades, or an equivalent amount, under the present state law? 50 had done so.

Question 2 How many have ever felt that they were getting too much physiology? None.

Question 3 How many have ever felt that they wanted more of the subject? 15 answered "yes".

Question 4 In how many cases has the interest in physiology been greater than the average interest felt in other subjects? Seven responded.

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[1] These questions were written out and read to the classes, all possible care being taken to avoid influencing the pupils' answers.

Question 5 In how many cases has the interest in this subject been less than the average interest felt in other subjects? 37 responded.

Question 6 How many can trace their aversion to the use of alcoholic drinks, or their disapproval of the same, to the teachings of the physiologies? None responded. (Much merriment in the Buffalo class)

Question 7 How many have ever known of others whose aversion to the use of alcoholic drinks was due to what they had learned of the subject from textbooks? One pupil knew of two cases occurring in the 9th grade of a certain school.

Question 8 How many have ever known of the correction of bad habits relative to the use of alcoholic drinks because of what was learned of their nature in school? None.

Question 9 How many have studied this subject where charts were used showing abnormal conditions of the organs? 22 had.

Question 10 In how many cases did the charts help to render the subject impressive? Two.

Question 11 Why did the charts fail so largely to impress the subject-matter? One said it was because some of the charts were not true, that their untruthfulness was recognized at the time. Another said that the children, inclusive of herself, were too young to understand the charts. A third said the charts were disgusting.

3 A third set of questions was sent out by J. E. Peabody to the physiology teachers in the high schools of the cities and larger towns of New York and New England. Copies of the paper were also sent to college and medical school professors and to prominent members of the Committee of 50. The circular was as follows:

1 The present state law prescribes that

The nature of alcoholic drinks and other narcotics and their effects on the human system shall be taught in connection with the various divisions of physiology and hygiene as thoroughly as are other branches in all schools under state control, or supported wholly or in part by public money of the state. All pupils . . . below the second year of the high school and above the third year of school work . . . shall be taught and shall study this subject every year with suitable textbooks in the hands of all pupils for not less than three lessons a week for 10 or more weeks. . . . For all students below high school grade such textbooks shall give at least one fifth of their space, and for students of high school grade shall give not less than 20 pages, to the nature and effects of alcoholic drinks and other narcotics. This subject must be treated in the textbooks in connection with the various divisions of physiology and hygiene, and pages on this subject in a separate chapter at the end of the book shall not be counted in determining the minimum.

Is it desirable to advocate any change in this state law? If so, what change should be made?

2 Should we emphasize, in teaching pupils, the difference between the effects of moderate and excessive use of alcohol?

3 If this distinction is made, shall we call the attention of boys and girls to descriptions of *delirium tremens*, hobnailed livers, etc.?

4 Authorities differ widely in respect to the effects of the *moderate* use of alcohol. Many of the most eminent physiologists claim this moderate use of alcohol is not injurious. In view of these facts, should pupils ever be taught that alcohol is always a poison?

5 Prof. Atwater's experiments seem to prove conclusively that alcohol in small quantity can be used like sugar, starch and fat for generating heat and muscular energy. Is it wise to describe these experiments to classes? (*See* Atwater's articles in *Harper's Monthly*, October and November 1900; *Outlook*, 1899. v. 62 and 63)

6 Statistics from the United States census in regard to pauperism, crime, insanity, and the cost of drunkenness are telling arguments against the present use (or abuse) of liquors in this country. Should these statistics be given in a course in physiology?

7 The rules of most corporations prohibit the use of intoxicants. Is it well to present to pupils this business argument for abstinence?

8 Please suggest the authorities that give the fairest view of the effects on the human body of alcohol and narcotics.

9 Shall we emphasize in teaching the difference in the effect of tobacco when used by youths and by adults?

10 What is the best form for our report, a series of categorical statements or a succession of quotations from authorities?

Nearly 100 replies were received, and the answers therein contained were tabulated.

In reply to question 1, relative to the state requirements concerning so called "scientific temperance instruction", only four expressed themselves as satisfied with the present law. Two others are in doubt as to the effect of the statute. All the rest condemn it either in part or *in toto*. The various grounds of dissatisfaction may be stated as follows:

a Too much time in the curriculum is assigned to the subject of alcohol and other narcotics. Many suggest that its consideration be omitted in several of the grades, stating that the wearisome repetition required by law leads either to indifference on the part of the pupil or to actual hostility toward the subject.

b The pressure brought to bear on textbook writers, because of the law, makes most textbooks unbalanced in their proportions, if not, as is often the case, actually untruthful in their statements.

c The statute fails to accomplish what it was destined to accomplish, viz, the growth of an intelligent sentiment against the evils of intemperance. Teachers declare that the teaching of physiology and hygiene, which ought to be of great help in the every day life of the pupil, is becoming synonymous with teaching the effects of alcohol and narcotics; indeed in some schools the textbooks in the subject are called by the pupils "the liquor books."

After tabulating the answers to question 2 on the circulars returned, we find that the distinction between the effects of moderate and excessive use would be emphasized by three fourths of the writers. About two thirds of the papers say that the extreme effects of liquor in cases of *delirium tremens* and pathologic livers should not be portrayed in a course in physiology given to boys and girls. Only one third, on the other hand, recommend the presentation of Prof. Atwater's recent important experiments on alcohol as a possible source of energy. In answer to the question, "Should pupils ever be taught that alcohol is always a poison?" four fifths of the papers register a decided no.

Turning now from the physiologic aspect of the question to its moral and economic bearings, we find substantial agreement that perhaps the best arguments against intemperance are those furnished by the statistics of pauperism, crime, and insanity. Nearly all agree, too, that the business argument in favor of abstinence or strict temperance should be advanced, but several of the writers protest against introducing either of the arguments just named into a course in physiology and hygiene.

As already stated, your subcommittee has devoted most of its attention to the consideration of the alcohol question as affecting the high school course. This was deemed advisable in view of the limitations of time. We believe, however, that the proper study of physiology in the elementary grades is of even greater importance, because of the practical teachings of hygiene that may be thus widely diffused. In this connection we are permitted to quote the following statement which will soon be published by a joint committee of the Teachers Association and Male Principals Association of New York city. This committee was appointed to recommend changes in the present New York city course of study.

> The committee deplore especially the unwise and burdensome teaching of physiology foisted upon our curriculum by an arbitrary state law. We earnestly recommend that the teachers associations and school authorities of the city initiate some movement looking toward a more rational use of the time that is now devoted to so called "temperance physiology." This teaching is intended to give children an abhorrence of alcoholic drinks; but, by the unpedagogic methods it employs, it succeeds only in cultivating in children an abhorrence of the beautiful and useful science of physiology.

Conclusions of the committee from the preceding investigations

1 Physiology is the only subject in the curriculum that is dominated by legislative enactment. The result seems to be that instruction is commonly given in a perfunctory way, or that the provisions of the law regarding temperance instruction are disregarded. It should be remembered that no law, however stringent, can bring about effective teaching when the statements presented to the pupils are questioned or disbelieved by the teacher.[1]

2 The teaching of the effects of stimulants and narcotics under the present system has not produced any marked change of sentiment in the young either for or against their use. If any change exists, it is entirely disproportionate to the outlay of time and effort which has been made.

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[1] While we recognize the importance of legislation relating to the subject and acknowledge the great service which the members of the Woman's Christian Temperance Union have rendered in the cause of temperance instruction, your committee is of the opinion that our present law could be amended so as to be more acceptable to practical educators and to promise more satisfactory results.

3 Whether the matter taught is or is not excessive in amount, it is unwisely distributed through the course, and there is frequent and unnecessary repetition.

4 As the result, diminished interest and dislike of the subject prevail.

5 The preponderance of opinion expressed indicates that instruction could profitably be limited to fewer grades, those between the 5th and 8th being preferred.

6 The use of textbooks should not be made compulsory earlier than the 6th grade, if at all.

7 Though the textbook may not always be satisfactory, the teachers do not regard this fact as a marked impediment to their work.

8 Charts showing morbid physiologic conditions are generally condemned.

9 The evils of alcohol and narcotics can be presented most effectively from the moral and economic point of view.

Recommendations of the committee

1 The New York State Science Teachers Association should urge that the present law be modified in such a way that teachers of physiology be given more freedom to decide as to the character and content of their teaching, and writers of textbooks more freedom as to the space devoted to the subject and its location in the volume.

2 We are interested in the recent changes effected in the law in the state of Connecticut, and look with favor on its present provisions. But, before recommending similar specific changes in our law, we deem it wise to allow a reasonable time to elapse for observation of the working and results of that law.

3 So long as the existing statute remains in force, if truthful instruction is to be given in the subject, the possible benefits of alcohol when prescribed by physicians should be conceded. The difference in the effects on the human body of fermented beverages (beer and light wines) and distilled liquors should also be noted. Emphasis should be laid, too, on the greater

susceptibility of young persons both to direct injury from the use of alcohol in any form and to the danger of forming undesirable habits. Pupils should be allowed also to know that there is wide disagreement among authorities as to the physiologic effects of a strictly moderate use of liquors by adults. On the other hand, attention should be called to the fact that the moderate use of alcohol very commonly leads to excess, and the teacher should emphasize the fact that an immoderate use of liquors weakens the tissues so that they are made more susceptible to disease.

4 Finally, if the teacher wishes to present the strongest arguments in favor of either total abstinence or strict temperance, and thereby fulfil the spirit rather than the letter of the law, your committee recommends that comparatively little time be spent in trying to teach the physiologic effect of alcohol and tobacco. Let us frankly admit that we are discussing not so much a question of physiology as one of morals and economics, and let us devote the larger part of the time required by law to a treatment of the question from the moral and economic standpoint.

IRVING P. BISHOP
BURT G. WILDER
GAYLORD P. CLARKE[1] *Committee*
ELI H. LONG
JAMES E. PEABODY

ALCOHOL PHYSIOLOGY IN THE PUBLIC SCHOOLS

BY PROF. W. O. ATWATER, WESLEYAN UNIVERSITY

Mr Chairman, ladies and gentlemen: The subject proposed for this afternoon is alcohol physiology in the public schools. Your committee have, however, asked me to repeat the substance of an address delivered before one or two other educational gatherings and, in so doing, to recapitulate briefly what I understand to be the outcome of the latest experimental inquiry regarding the physiologic, and specially the nutritive, action of alcohol and to say something also about the kind and amount of instruction which should be required by state legislation and should be given in the schools.

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[1] Unable on account of illness to take part in the final work of the committee.

If I may be excused for the indiscretion of giving the conclusions of my address at the beginning, they will be somewhat as follows. The amount of teaching of temperance physiology and the space given to it should be much less than are required by the legislation of a considerable number of states, including your own. The kind of teaching should be that which agrees most closely with the attested principles of physiologic science, that which is both scientifically and pedagogically most reasonable.

This, in my judgment, means a material modification of the legislation in many states, and an equally important change in the character of a large amount of the textbook instruction. These changes I believe to be called for in the interest of sound science, sound pedagogy, sound morals and effective temperance reform.

In this connection I am inclined to say a word in behalf of another subject. When we consider that "half the struggle for life is a struggle for food," that "half or more than half the earnings of the wage-earner is spent for the nourishment of himself and family," that not only a man's power to work but also his health, are largely affected by his food, that some of our most skilled hygienists are telling us that a large part of the disease which embitters life and hastens death is due to avoidable errors in diet, that more harm comes to the health of the community from erroneous habits of eating than from the habitual use of alcoholic drink, that economists, philanthropists and divines are urging more and more earnestly the need of attention to such subjects, are we not justified in asking if a little more room can not be found for it in the school curriculum; if some of the time and space now devoted to alcohol physiology might not be better given to food and nutrition in general?

But after this digression, let us come back to our subject. The purpose of all our instruction is to impart knowledge, provide mental discipline and build character. The temperance instruction has, in addition, a special purpose, namely, to promote moral reform. The so called "scientific temperance instruction" current in our schools seeks the latter purpose by impressing on our children the belief that science demonstrates that alcoholic beverages, even in very small quantities, are injurious to health. To enforce this teaching two means are adopted. One is the legislation which now requires the general subject to be taught in the public schools of all the states of the Union, I believe, save one. The other is found in the so called "approved" textbooks which put the special doctrine in the desired form. The same powerful agency which has secured this legislation—and the achievement is most noteworthy—has been able to influence and sometimes to control, in a large measure, the character of this instruction in the schools, by favoring the textbooks which have, and opposing those which have not its official approval.

I doubt if it is quite true, as the leaders of this great educational movement assert, that physiology as conformed to the doctrine of total abstinence is being taught to 16,000,000 children in the United States, because even the present combination of legislation and textbooks does not insure its being so taught in all schools; but the extent of the teaching is very great. The whole is accomplished by such diligence and such moral earnestness, that it has thus far been almost invincible.

Thus it comes about that we have in the United States a great educational movement which is attempting to build moral reform on a basis of scientific doctrine which the best scientific authority disapproves. Perhaps the matter has not occurred to you all in just this light before, but is not this a fair statement of the case?

A large and increasing number of men of science are coming to realize that scientific error has found its way into the curriculums of the schools and are earnestly considering what shall be done to correct it. A large and increasing number of intelligent and conscientious teachers are coming to feel more and more deeply the harm which comes from what they consider to be false science and wrong pedagogic methods and are earnestly considering how they may be freed from the responsibility of the teaching, and how the children in their care may be freed from the harm that it brings.

We often hear the statement that nothing in the public education of our time has met with so general or so earnest disapproval from the best educators and most conscientious teachers as have the so called approved physiologies and the scientific temperance instruction. How true this is, I am not competent to judge. Certainly nothing I have ever known in any educational system has seemed to me to be so unanimously condemned by scientific specialists as a considerable part of the physiologic doctrine regarding the action of alcohol, which this instruction promotes. This is a strong statement. I should feel unwarranted in making it without adding another consideration, namely, that this same instruction has behind it an immense amount of earnest moral conviction. In every state of our Union, save one, are laws requiring temperance physiology in the public schools. This fact in itself is a remarkable phenomenon. It would have been impossible without an amount of conviction on the part of the best elements of the community which can hardly be overestimated. The movement has the support of a great body of people, profoundly interested in education and morals, tremendously earnest in their self-sacrificing efforts to promote temperance reform, convinced that the present teaching is called for and proper, and determined that it shall be enforced.

There is a clash between physiologists and teachers on the one hand and moral reformers on the other. Both are seeking the same object, the welfare of the children who are to be our successors, the building up of the public opinion of the future for the sake of the welfare of the future. On the main issue we are united; we differ as to the method. What is to be done about it?

The first need, I think, is that the public understand the situation. If the real import of this legislation, the kind of scientific doctrine it was intended to introduce, the conflict between that doctrine and what is commonly accepted by scientific authorities and is believed by wise and conscientious educators had been understood, I can hardly believe that the legislation could have become so general. Earnest reformers have seen a great physical and moral evil to be met and have believed that this was the way to meet it. All they have asked of the public has been an act on the statute book to require better instruction in the schools. This the legislatures have been led by public opinion to grant. I think the time has come for teachers to take up the question and show how the legislative and other influences have been utilized to force into our public school education an element which is scientifically, pedagogically, and ethically, most unfortunate.

I think it is safe to say that our present legislation has been introduced without a fair understanding of the facts. Its promoters have seen very clearly one side of the question, the awful harm which is wrought by alcohol. Wives and mothers, in thousands and in millions, feel with a force that outstrips all opposing argument the curse which drinking brings to homes, to hearts and to lives. Husbands and fathers, clergymen and philanthropists sympathize with them. Earnest men and women, impressed with this feeling, have believed, and honestly believed, the fundamental doctrine which the legislation is intended to enforce. They have said: "Let us see to it that the effects of alcohol are taught to our children. Let us fortify them against temptation. Let us provide for the temperance sentiment of the future by the education of the youth of the present." The appeal to the legislator has thus been backed by the moral sense of the community. There has been protest against the legislation, a protest rational and earnest, but unorganized and ineffectual.

The surprise with which many intelligent people receive the statement of the real facts which physiology teaches is, in itself, an indication of the misunderstanding on which this legislation has been based and which the teaching has fostered. While I am in the fullest sympathy with the purpose and while I would not oppose all legislation of this kind, I believe, as I know many of you believe, that in its present form, the legislation is unfortunate and ought to be changed. I do not believe, however, that it will be changed till the subject comes to be clearly understood by the public at large. With that clear understanding of the real facts and principles, I believe that the public will demand that the laws on our statute books be made more rational, and I believe that the conservative and influential promoters of temperance reform will unite with educators in other states, as they have done in Connecticut, to secure such changes in our legislation and in our textbooks as will best conduce to the end which we all so earnestly desire.

The principle I wish to urge is this: if the alcohol physiology now being taught in our public schools as a branch of science is scientifically correct, then it can not be pedagogically or ethically wrong, and there is little reason for my discussing the subject today. But, if it does not tally with the most reliable conclusions from scientific observation and experiment, if what is taught as truth is half truth or partial truth, if doubtful theories are set forth as settled facts, if a rule of conduct is based on an unsound theory, if the attempt is made to improve the morals of the men of the future by a wrong teaching of the boys of today, that educational policy is pedagogically and ethically wrong and ought to be altered.

As teachers you know the current textbooks; may I invite your attention to the opinions of leading authorities regarding the physiologic and more specially the nutritive action of alcohol?

Opinions of leading authorities

The physiologic action of alcohol is very complex, and the views of physiologists generally regarding the different details are naturally divergent. Let us take, for instance, the much discussed question as to whether alcohol is food or poison.

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First of all we must have a clear understanding of what we are talking about. A given substance taken into the body may act in a variety of ways. Meat, beefsteak for instance, which is universally called a food, supplies the body with material to build up its tissues, repair its wastes and furnish it with energy in the form of heat to keep it warm and muscular power for work. It also has an action on the nervous system which is not yet fully explained but may perhaps be called stimulative. Taken in excess, it may be injurious; its action is then pathologic. Being thus injurious, it might under these circumstances be called poisonous. Arsenic is sometimes taken as a medicine, and as such is believed to be useful, though we do not know exactly how or why it is so. But arsenic has no value whatever as nutriment and therefore can not be called in any sense a food. In more than minute doses it is deleterious or fatal. It is a true poison. There are certain vegetable products which, fed to animals, supply nourishment, but at the same time are injurious, so that they can not be used for food. Chemists have analyzed some such substances and found ingredients which are nutritious and others which are injurious. That is to say, some substances are clearly foods, some are clearly poisons, some act in both ways. How, then, shall we class alcohol? What I shall attempt to show you is that the results of the most valuable scientific research and the opinions of the leading physiologists of the world unite in saying that it may be either food or poison or both according to circumstances.

Alcohol is not like the meat or the seed, a complex material made up of different ingredients. It is a simple chemical substance. Nevertheless, it has very different actions. A chemist can analyze the seed and separate the parts which are nutritious from those which are poisonous. But he can not do this with alcohol. When the physiologist experiments on its action, he has to take it as a whole. This complicates the experimenting and makes the interpretation of the results difficult.

When we come to consider the dietetic use of alcohol, however, we must take into account not only its direct value for nutriment but also its indirect action, as for instance, its effect on digestion. So likewise when we consider its pathologic effect, we must take into account its indirect action on the nervous system. Indeed, if we are going to study the subject at all thoroughly, we must recognize many subdivisions. Since we can not go into the details here, let me briefly summarize what appear to me to be the views of leading physiologists of the world. What do the authorities say in answer to the question, is alcohol food? Of course the answer depends first of all on the definition of food. But people may properly differ as to the definition, and it is not worth while to quibble about what may be left to the dictionaries. Let us then go back of this and ask, What do the specialists say as to its nutritive effect?

If we study the views held by the physiologists and pharmacologists in this country and in Europe, who are regarded by their fellow specialists as best qualified to speak with authority, we may perhaps divide them in three groups. At one extreme would be a small group who take grounds, more or less strongly, against any dietetic use or value of alcohol, but even this group would generally admit, I think, the absence of proof that alcohol does not supply the body with nutriment. There is a second group who are inclined to favor the moderate dietetic use of alcohol, tending to class it with nonproteid food materials, like sugar, starch and fat, but still maintaining that its classification as a food is not clearly established. And where they are inclined to question its value for directly supplying the body with nourishment, they maintain that it may be valuable as an aid to digestion and otherwise and find in this another reason for using it as part of the diet. A third group, whether they advocate or oppose its use, regard the evidence as sufficient to pronounce alcohol, in moderate quantities, a food in the sense that it may serve for nutriment, and many urge that there are circumstances in which its nutritive value is very important. Whether alcohol is or is not a poison, is likewise a question of definition. Here again wise men may disagree; but back of this lies the important question, is it injurious? That alcohol may be injurious, that in large enough doses it is unquestionably a poison, and that in smaller quantities, taken habitually, it may be extremely harmful, there is no shadow of doubt. On this point there is no disagreement of authorities. But whether, or under what circumstances, it is injurious when taken in moderate quantities is a very different matter; and here opinions disagree.

The opinion of Prof. Fick, that alcohol in small amounts should be called poison, has been often quoted and is, I believe, made the principal basis of the statement in many of our school textbooks that alcohol is called a poison by the highest scientific authorities. But Prof. Fick defines poison in a way which, be it right or wrong, gives to the word a meaning quite different from that in which it is popularly used. He is one of the group of physiologists who practically deny any food value to alcohol. So far as I am aware, however, their number is small, and it is, I think, being reduced as the result of late research.

I have looked into many of the standard treatises on the subject and have conversed with many eminent physiologists, pharmacologists and chemists about it. In so doing, I have rarely seen or heard alcohol in small quantities called a poison, in the ordinary sense of the word, by any specialist who is generally regarded as an authority. Indeed, as I write this, I do not recall a single instance, but I should not feel warranted in saying that there are no such instances because they are things which one might forget, and furthermore, there may be many which I have not happened to see. I have no doubt that, if I had been looking specially for evidence on this side of the question, I might have found a good deal more than what I have just said implies.

To bring the various uses of food out more clearly, let me remind you that our foods contain different classes of nutritive materials or nutrients. One of these classes includes the nitrogenous substances, protein compounds or proteids, as chemists call them. The myosin which is the basis of lean meat, the albumen or white of egg, the casein which makes the curd of milk, the gluten of wheat, are familiar examples of proteid compounds. They are transformed into blood, muscle, bone and brain. They are the true tissue formers of the body, the materials which serve for building the bodily machine and keeping it in repair. They also serve the body for fuel, but their use in this respect is limited. The fats, like fat of meat, the butter fat of milk, and the oil of cotton or of olive, make a second, and the carbohydrates, which include the starches and the sugars, a third class of nutrients of food. The fats and carbohydrates lack the chemical element, nitrogen, which is characteristic of the protein compounds, but they contain large proportions of carbon and are sometimes called the carbonaceous nutrients. By their oxidation, i. e. burning, in the body they yield its principal supply of energy.

Bread, meat, milk and the like contain both the nitrogenous and the carbonaceous materials. Meat lacks the carbohydrates; to make a well rounded diet, we use bread, potatoes and other vegetable materials with the meat. Bread and milk may be called complete foods, as they contain all three of these classes and with them the other ingredients necessary for nutrition. Such complete foods not only build the bodily machine and keep it in repair, but also supply it with fuel.

While proteids serve for building tissue and have a limited value for fuel, we could not well live on proteids alone. They are not complete foods. Fat, starch and sugars are not complete foods. They can not build tissue; nevertheless, they make the larger part of our food, for the reason that our bodies need more material for fuel than they do for building and repair.

Alcohol can not build tissue, it has no nitrogen. It can not be stored in the body for future use as is the case with fats, nor can it be transformed into fat and thus stored in the body as is the case with the sugars and starches. But it is oxidized in the body and does yield energy. In this respect it is analogous to the fats, sugars and starches. Just how it compares in fuel value with the fats, sugars and starches, or just how these compare with one another in fuel value are questions as yet unanswered.

Alcohol is, then, at best a partial food. To call it food, in the popular sense of the word, and without qualification, may produce a wrong impression. Furthermore, its action on the nerves and otherwise in the body, is such that only very small quantities can be taken without serious derangement. When taken habitually in excess, it is not only injurious to health but ruinous to character. And, while its nutritive action may be very important in some cases, specially with aged people or in certain forms of disease, people generally do not take it for the sake of its nutritive value at all.

Taking the word poison in the sense in which it is commonly understood, namely, as applying to substances which are deadly in their effect, alcohol in small quantities can not in my judgment properly be called a poison. It may be injurious in one case and not in another. Just where to draw the line between the quantity which may serve only as food and that which acts as poison is impossible. The amount that can be taken without injurious effect differs with different people. And, even though there are conditions in which it is not injurious and is even useful, yet there is the danger that it may lead to excess, a danger which, as teachers of youth, we must not, we dare not forget. This fact, coupled with the demoralization that comes with its habitual and excessive use, constitutes, in my judgment, the chief argument against its use.

But I have started to give you the opinions of leading physiologists and have indiscreetly gone out of the way to give you my own, and that, too, when I am only a physiologic chemist. Let us go back to the authorities. At the meeting of the International Physiological Congress, held in Cambridge, England, in September 1898, an effort was made to obtain an expression of opinion which might be taken as a consensus of leading physiologists regarding this special subject. The occasion had brought together some of the best known authorities from the different countries of Europe, America and even Africa and Asia. The congress did not include a great number of men, but it did include a number of great men. The following statement which was drawn up by Prof. Michael Foster of the University of Cambridge, who was the president of the congress, was printed and offered for signature.

> The physiological effects of alcohol, taken in a diluted form, in small doses, as indicated by the popular phrase "moderate use of alcohol", in spite of the continued study of past years, have not as yet been clearly and completely made out. Very much remains to be done, but, thus far, the results of careful experiments show that alcohol, so taken, is oxidized within the body and so supplies energy like common articles of food, and that it is physiologically incorrect to designate it as a poison, that is, a substance which can only do harm and never good to the body. Briefly, none of the exact results hitherto gained can be appealed to as contradicting, from a purely physiological point of view, the conclusions which some persons have drawn from their daily common experience that alcohol so used may be beneficial to their health.

I was present at the meeting and conversed with a number of the gentlemen present regarding the statement. Only a very few, so far as I heard, had any hesitation with regard to it. I learned of two or three who were unwilling to sign it without slight changes in the phraseology. I was told of one who said he believed it, but did not like to sign it, because it might be employed by liquor-sellers as an encouragement to their trade. There may have been a considerable number who disagreed with the statement in one way or another, but, if the number had been at all large, I think I should have known it. Certain it is that a very considerable number of the most celebrated men present expressed their decided approval in personal conversation. I have here a list of 62 men who expressed their approval by their signatures. Nearly all are well known investigators. Among them are professors, teachers and heads of laboratories of a large number of the most noted universities and medical schools of the world. The list includes many of the most celebrated physiologists of our time.

The following, also by Prof. Foster, is interesting, not only as a concise summary of what is definitely known about the physiologic action of alcohol, but also as showing how much space should, in the judgment of one of the most reputable of modern physiologists, be devoted to the subject in an elementary text-

book. It fills two of the 247 pages of the *Elementary Physiology* of Foster & Shore.

Alcoholic beverages. Ordinary alcohol is an organic compound of the composition of C_2H_6O. It occurs in the following proportions in the following beverages:

Beer	about	5	per cent
Light wines (claret, hock)	"	10 to 15	"
Strong wines (sherry, port)	"	20	"
Spirits	"	30 to 70	"

When alcohol is taken into the body, most of it is oxidized and gives rise to energy. The amount of energy thus supplied, compared with that of the other parts of the food, is insignificant, and the effect of alcohol depends not on the energy which it supplies, but on the influence it exerts on the changes going on in the several tissues. The value of the various articles of diet does not depend by any means solely on their ability to supply energy; we have seen, for instance, that salts which supply no energy are nevertheless of use in directing the changes going on in the body. In a somewhat similar way alcohol and other substances may influence and direct these changes. Whether that influence is beneficial or no will depend upon many circumstances, and certainly upon the quantity taken. We have many illustrations that a substance taken into the body in a certain quantity will produce one effect, and in another quantity it may be quite an opposite effect. There is no doubt that a certain quantity of alcohol is injurious and interferes with all the functions, and ultimately brings about various diseases, but it does not follow from this that in a smaller quantity it may not be harmless or even beneficial.

Alcohol produces its most marked effects on the vascular and nervous systems. It leads to a dilation of the small blood vessels of the skin, and so to a larger flow of blood to the surface of the body; this, while it produces a sensation of warmth, leads to an increased loss of heat by radiation and perspiration. If the amount of alcohol taken is excessive, the loss of heat will lead to a definite fall of temperature. Alcohol is then of no service as a preventative against cold.

Alcohol makes the heart beat more quickly and makes it do more work in a given time. In some cases this may be beneficial, but generally it is a wasteful and useless expenditure of energy. Alcohol diminishes the power of doing prolonged muscular work, and large quantities lead to a great diminution in the force of muscular contractions.

The effect of alcohol on digestion is very complex. When taken with food it leads to a diminution in the rate and completeness of digestion, if it is present in any but very small quantities. If some proteid (white of egg or fibrin) is put in a flask with some gastric juice, it is found that if a very little alcohol (1 part to 500 of the mixture) be added, the digestion will go on a trifle more rapidly, but if the alcohol added much exceeds the amount, a well marked retardation is produced. It does not follow that such a small amount of alcohol is useful in ordinary digestion, because when it is taken into the stomach we have to consider the influence it has on the secretion of gastric juice, on the movements of the stomach, and on absorption. A small quantity of alcohol appears, however, to encourage the secretion of gastric juice, but large quantities act injuriously on all the processes of digestion.

A small amount of alcohol may promote the action of the central nervous system, and often appears to quicken the rapidity of thought and to excite the imagination, but more usually, and always when taken in any but small quantities, it diminishes the power of connected thought and judgment. It also diminishes the power of receiving sensory impressions, and at the same time blunts all the special senses. Since it reduces the sensibility to cold and fatigue and allays mental pain and worry, it is often resorted to, and then with great danger.

The limit up to which any beneficial effects are produced by alcohol is soon reached, and beyond that it only does harm. This limit is not the same for all individuals; a quantity good for one may be injurious for another, and a large number of people find that strictly moderate quantities of alcoholic beverages do them no harm, while others find that similar amounts impede them in their daily work.

The effect of alcoholic beverages does not depend solely on the ordinary alcohol in them, for other substances which they contain often have powerful actions in the body. The habitual use of such beverages to excess greatly shortens life by inducing diseases of many organs. In some cases of disease alcohol may be of great service, but in health it can not be considered a necessity, and is far more potent for evil than for good.

From the evidence at hand regarding the use of alcohol, the following, by Dr E. A. Parkes, the eminent English hygienist, seems to me a fair and judicious statement of the facts, though I should be inclined to lay a little more stress on the principle that, in health at any rate, it is superfluous or worse, and to insist more strongly on the importance, in this country specially, of general abstinence from its use.

The facts now stated make it difficult to avoid the conclusion that the dietetic value of alcohol has been much overrated. It does not appear to me possible at present to condemn alcohol altogether as an article of diet in health; or to prove that it is invariably hurtful, as some have attempted to do. It produces effects which are often useful in disease and sometimes desirable in health; but in health it is certainly not a necessity, and many persons are much better without it. As now used by mankind, it is infinitely more powerful for evil than for good; and, though it can hardly be imagined that its dietetic use will cease in our time, yet a clearer view of its effects must surely lead to a lessening of the excessive use which now prevails.

During the past 25 years I have been interested in this subject and have taken pains to read about it and to talk about it with many men who are recognized as the leading authorities in this country and in Europe. If I wished, I could easily select statements from a limited number of men that would conflict with the opinions thus expressed. But, if I try to get the consensus of opinions of the men who do the most of the experimenting and the observing, the men who have that habit of mind which is called scientific, the men who are considered by their fellow specialists the most reliable and the most authoritative, I hardly know how to express it better than in the language I have just read to you from Foster and from Parkes.

Reference has been made in the public prints to some experiments under my own direction at Wesleyan University which have had for their object the study of the nutritive action of alcohol. One does not like to say a great deal about one's own work, and I should rather stop with the references to what other investigators have done and said; but in view of the misstatements and misunderstandings which have received currency regarding these inquiries and the conclusions we have derived from them, it is perhaps fitting that I should refer to them now, as I have been specially requested to do.

The experiments in question have been undertaken in behalf of the Committee of 50 for the Investigation of the Liquor Problem, a body of gentlemen who have devoted themselves to inquiry regarding the action of alcohol. The committee is made up of business men, jurists, economists, sociologists, educators and divines, including some of the most prominent men in the country in their several callings. The committee have divided themselves up into subcommittees, and one of these subcommittees is that on physiology. The physiologic work has been divided among the individual members, and it happens that to myself was allotted the subject of the nutritive action of alcohol. The expense of the different inquiries has been borne mainly by private contribution, though sums have been received from certain trust funds devoted to scientific inquiries.

The experiments under my own direction have been materially facilitated by the use of laboratory privileges in Wesleyan University. They were carried out in connection with a series of researches on nutrition which are made under the auspices of the United States Department of Agriculture and constitute part of the larger inquiry into the economy of food, which is under my charge.[1]

The experiments are made by the use of the respiration calorimeter, by means of which it is possible to measure the income and outgo of the body of a man, as expressed in terms of both matter and energy. The apparatus includes a chamber about 7 feet long, 4 feet wide and 6½ feet high, in which the man stays for a number of days and nights. It is furnished with folding bed, table and chair. For some of the experiments, those in which muscular work is to be done, there is provided a stationary bicycle, on which the man may ride the equivalent of a desired number of miles per day. Arrangements are provided for ventilation by a current of carefully purified air. The temperature is kept constantly at a degree which is agreeable to the occupant. In this chamber, he reads, writes, eats, drinks and sleeps. So far from being uncomfortable, each of the five gentlemen who have been subjects of the experiments thus far has found himself very little discommoded in any way save for the monotony of confinement in so small a space. The period of each experiment generally varies from four to nine days, though in one case it reached 12 days. Even after this experience not one of the gentlemen has been in the least unwilling to repeat the trial. So far from finding difficulty in securing subjects, we have numerous volunteers and are able to select men of special fitness for the purpose as regards both bodily characteristics and, where desired, scientific training.

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[1] The results are given in detail in a memoir of the National Academy of Sciences, which is printed at the government printing office in Washington, and may be obtained by application to the secretary of the National Academy of Sciences, Washington D. C., or to members of Congress. A shorter account will be included in a report of the Committee of 50 on the physiological action of alcohol, soon to be published by Houghton, Mifflin & Co., Boston.

The special object of the experiments with alcohol was to study its nutritive effect as compared with that of the fuel ingredients, fat, sugar and starch, carbonaceous compounds, let us call them, of ordinary food. In most of the experiments pure (ethyl) alcohol was used, though in some the alcohol was given in the form of whisky or brandy. It was administered with water or coffee and taken with an ordinary diet of meat, bread, butter, milk, sugar, and the like. The amount of alcohol per day has been equal to about 2½ ounces of absolute alcohol—about as much as would be contained in three or four average glasses of whisky or in a bottle of claret or Rhine wine. This is generally divided in six doses, three with meals and three between meals, the object being to avoid any marked influence of the alcohol on the nerves and thus to test its action as food under normal bodily conditions. Comparative tests were made by use of rations with and without alcohol. The ration without alcohol consisted in each case of ordinary food materials supplying the nutritive ingredients in amounts more or less nearly sufficient to meet the wants of the body. In the corresponding ration with alcohol, part of the sugar, starch, and fat of the food, the carbonaceous ingredients which supply the body with fuel for warmth and work, was taken out, enough to be equivalent in potential energy to the two and one half ounces of alcohol, and the latter was used in their place. In the experiments in which the man did not work, this alcohol made about one fifth of the total material in the diet. In the experiments with hard muscular work, in which more food was used, the alcohol furnished about one seventh of the fuel supply. 13 experiments in which alcohol was used are now completed, and the results ready for publication. These are compared with a somewhat larger number of experiments similar in the main except that they were without alcohol.

The results will be best understood if we consider that alcohol is compared with the ordinary fuel ingredients of food—the fats, sugars and starches. These serve the body in several different ways. (1) They are oxidized in the body. (2) In the oxidation their potential or latent energy becomes kinetic or active. (3) Part of this energy takes the form of heat, which keeps the body warm. (4) Part takes the form of muscular energy, with which the muscular work of the body is done. (5) In being oxidized the fats and carbohydrates of the food protect the fats of the body and of other foods from oxidation. (6) In like manner they protect protein from consumption. The question then is, Does alcohol serve the body as fuel in these several ways? We shall see later that the answer is in the affirmative.

Before going into the details, however, we may note certain differences between alcohol and the fats and carbohydrates. Some of these are the following. (7) The ordinary nutrients of food have to be digested. This is done by the action of ferments in the alimentary canal. Alcohol, on the other hand, requires no digestion; it is itself a product of fermentation, it is a predigested food. (8) The ordinary nutrients of food may be and commonly are stored in the body and kept for future use; alcohol can remain in the body but a short time without being oxidized. (9) Alcohol has various effects on the nervous system which are not exercised by ordinary food.

In considering the results of the experiments at Middletown we shall do well to take into account the outcome of other inquiry and thus arrive at conclusions of more general value.

In the very interesting report which was made by your committee and which voices the sentiment of a large number of excellent people to whom the questions were presented, I believe one of the questions was somthing like this: " Should the experiments of Prof. Atwater on the effects of alcohol be included in the instruction?" I understand that a minority answered in the affirmative. If I might be permitted to express my own view, it would be with the majority; I do not think that any particular set of experiments are worth putting into such instruction when there is so much of great importance in the way of conclusion.

What should and should not be taught about this subject in the schools

Will you permit me to state some of the things which, as it seems to me, ought and ought not to be taught in the public schools? In so doing I do not attempt to cover the whole ground or enter into the physiologic details, but simply indicate what, in my personal view, should be said or not said about some of the more important phases of the subject. Of the forms of its physiologic action I select two, its action as food and as poison.

What we should not teach about alcohol

1. We should not teach that it is a food in the sense in which that word is ordinarily used. If we are going to discuss its physiologic action at all, we can not well ignore its nutritive value, but we should at the same time emphasize its limitations. When we speak of it as food or nutriment we should explain to what extent and in what ways it can and can not nourish the body. So likewise, if we speak of its effect on digestion, we should not say simply that it is an aid or that it is a hindrance, but that it may be one or the other or both according to circumstances.

2 We should not teach that it is a poison in the sense in which that word is ordinarily used. We may say with truth that alcohol in large quantities is poisonous, that in large enough doses it is fatal, and that smaller quantities taken day after day will ruin body and mind. But it is wrong to teach our boys that alcohol in small quantities, or in dilute forms in which it occurs in such beverages as wine and beer, is a poison in the ordinary sense of the word. In all that we say on this subject we must bear in mind that the intelligent boy knows well, and as a man he will know better, that people have always been accustomed to moderate drinking as it is commonly called and yet live in excellent health to good old age. If we tell him that alcohol in small quantities is poisonous in the sense in which he understands the word, he will see that we are exaggerating, that we are teaching for effect, and he will instinctively rebel against the teaching.

We may say, and say truthfully, that the moderate use of alcohol is fraught with danger. But the cases where the occasional glass leads to marked excess are the exceptions. If we present them to the thoughtful boy as the rule or the common result, he will detect the fallacy and distrust the whole doctrine.

We may be right in saying that alcohol often does harm to health when people do not realize it, that it prepares the system for inroads of disease, that there is a gradation of injury from forms scarcely perceptible to the utter ruin of body and soul. But to present the "horrible examples" as a common result of drinking is illogical in itself, contrary to right temperance doctrine and hence injurious to the children whom we teach. For that matter I believe that the picturing of the frightful results of vice to young and innocent children is more harmful than useful.

3 We ought not to teach that alcohol in small quantities is harmless. Still more should we avoid saying that it is commonly beneficial. Some of us as individuals may believe that its use in small quantities is generally desirable, but there is nothing in either the facts of common experience or in the results of scientific inquiry to justify the inference as a general principle. Doubtless many people, specially those in advanced age, or suffering under certain forms of disease, are benefited by alcoholic beverages in moderate amounts. Here it may have a decided medicinal value, and my own belief coincides with that of a great body of physiologists in ascribing to it under some such circumstances an extremely important food value, though the exact ways in which it is useful are not yet demonstrated. But I can see no justification for the claim that moderate drinking is generally useful, and there is no denying the terrible fact that it is often harmful, not only in itself, but because of the excess to which it so often leads.

4 We ought not to teach that alcohol in small quantities is always or necessarily harmful. Some of us as individuals may believe this. Honestly believing that theory, we may be justified in arguing for it. But we are not justified in teaching it

dogmatically, and in my judgment, it is positively wrong to make such a dogma a part of the instruction which is presented to our youth as authoritative, be it in the school, the Sunday school or the pulpit. It is wrong for two reasons: first, because it presents an unproved theory as an attested fact; and second, because it leads the trusting child to believe what the thoughtful, and at times skeptical, boy or girl, and the intelligent man or woman may afterward learn to be wrong.

5 Still worse is it to take the theory that the use of alcohol in small quantities is always or necessarily injurious, and set it up as demonstrated by scientific observation and experiment. This is positive untruth. If we tell it to children, they will believe it till they learn better. They may possibly remain in ignorance of the error till they are grown or indeed all their lives. But sooner or later many of them will find that they were deceived; it may be in the high school, it may be in the college or medical school; it may be from general reading or conversation; but, when the deception is found out, a reaction comes. The good we tried to do is undone. The certain injury is far greater than the hoped for good.

To take the theory that alcohol is in no sense a food but always a poison, that it is never useful but always harmful, and allege that it is supported by the great bulk of scientific authority, is falsehood. We may look over the literature of the subject and cull out statements which can be used to support it. We may even find writers of more or less repute who attempt to defend it in the light of scientific experiment. In this way we may accumulate statements which the unsuspecting reader may be led to regard as proving that the scientific authority is on this side of the discussion. We may unconsciously go further and persuade ourselves that there is scientific ground for adopting such theories; so often and so truly is "the wish the father to the thought." In our great anxiety to find every means to work against the evil wrought by alcohol we may gradually come to feel ourselves justified in presenting all the arguments we can against it and in ignoring all we can on the other side. But this does not turn theory into fact or falsehood or misrepresentation into truth.

Your committee have cited from so called "approved" text-books of physiology commonly used in our schools. The following quotations are of the same order:[1]

> Alcoholic drinks greatly hinder the work of the stomach. They cause the pepsin in the gastric juice to precipitate or sink to the bottom instead of remaining dissolved as it ought in this important digestive fluid. The gastric juice, thus deprived of its pepsin, loses its power to dissolve the food, which therefore has to lie in the stomach until the glands can throw in enough new juice to destroy it. *Eclectic*, no. 2. p. 55.
>
> Alcohol is universally ranked among poisons by physiologists, chemists, physicians, toxicologists, and all who have experimented, studied and written upon the subject, and who, therefore, best understand it.[2]
>
> Alcohol is not a food or drink. Medical writers, without exception, class alcohol as a poison.[3]
>
> It must be remembered that in whatever quantity, or wherever alcohol is found, its nature is the same. It is not only a poison but a narcotic poison.[4]
>
> Beer is a fermented drink made from barley or other grain. . . The alcohol remains in the beer, making it a poisonous liquor. When the grape juice has been squeezed out and its sugar turned to alcohol, it is a poisonous drink.[5]

These statements are misrepresentations. They belong to a kind of doctrine which pervades many of the "approved" text-books and much of the common temperance instruction. They are none the less false or wrong, either scientifically or morally, because the object is to educate our youth away from evil; the misstatements are none the less reprehensible because they occur in school books which have the official indorsement of a great temperance organization, whose membership includes thousands and thousands of the noblest, the most conscientious, the worthiest, of the women of the world. Nor does it help the matter that such statements are repeated and such theories are promulgated with the sanction, and are enforced by the authority, of the church, in the teachings of the Sunday school and from the sacred desk.

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[1] See note at end of this paper.
[2] Quoted from Youmans in Blaisdell's no. 2. p. 232.
[3] Eclectic, no. 3. p. 57.
[4] Authorized Series, no. 3. p. 58.
[5] Authorized Physiology Series, no. 2. p. 45 and 49.

Do not misunderstand me. I am not imputing wrong motives, I bring no railing accusation, I charge no one with intended wrong. I only ask that the men and women who do these things—many of them are my acquaintances, some are my warm personal friends, their standing in the community is so high that no arrow of aspersion can reach them, their characters are so pure that no stain can tarnish them, their names are in my memory and their faces in my vision, as I write this—I ask, that they consider the facts as I am sure they have not considered them, that they look into the evidence as I am sure they have not looked into it, and that they remember in their attitude toward these questions the principle I have read in their own writings and heard from their own lips—the foundation of morality is the truth.[1]

What we should teach about alcohol

1 It is, under some circumstances, a valuable nutriment in the sense that it can yield energy to the body but not in the sense that it can build tissue. It is, under other circumstances, a poison in the sense that it is injurious to health. When taken in large enough quantities and for long enough time, it is destructive to life. It is sometimes very useful and sometimes very harmful, but the harm that comes from drinking, in many communities, vastly exceeds the good.

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[1] A number of years ago, a representative of a large publishing house said to me: "We publish school books. To make our business successful, we must have a good assortment of books. In order to sell the arithmetic and grammar, we must have a physiology also. In order to sell the physiology, it must be 'approved.' To secure the approval we must put a lot of stuff into it which is not true. Generally speaking, we consider it to be our business to make books and sell them, and leave the responsibility for the contents to the authors. But, when it comes to school books, we can not get rid of the responsibility and we can not sell the physiology without doing an amount of lying of which we are heartily ashamed."

We can well appreciate a remark which the author of a popular series of school physiologies made to Prof. Bowditch of the Harvard medical board. When asked how he could justify the unscientific statements, the author replied with warmth, "I have studied physiology, and I do not wish you to suppose that I have fallen so low as to believe all the things I have to put into those books."

I have conversed with not a few publishers and authors of school physiologies, and they all say the same thing. The story is a sad one.

While we can not deny to alcohol a nutritive value, that value is very limited. In yielding energy to the body it resembles sugar, starch and fat, though just how and to what extent it resembles them experimental inquiry has not yet told us. It differs from them in that it does not require digestion and is hence believed to be more easily and immediately available to the body. It is not stored in the body for future use like the nutrients of ordinary food materials. The quantity that may be advantageously used is small. If large amounts are taken its influence on the nerves and brain are such as to counteract its nutritive effect and it becomes injurious in various ways. And finally there are many people who begin by moderate use and are led to disastrous excess.

Alcohol may be useful to one man and harmful to another. One may take considerable without apparent harm, while another may be injured by very little. One may use it habitually without injury, while another may not. In sickness it may be a priceless boon. But it may likewise be the cause of physical, mental, and moral ruin.

2 The boy or the man, as long as he is in good health and does not need alcohol for medicine, is in general better off without it.

3 While some can drink a little without danger of drinking to great excess, others can not. The safest way is to keep out of danger.

4 There are business considerations, also, as well as those of health that strongly favor temperance. The boy who wants to make his way on a railroad or in a large business establishment, has a better chance to get employment and to work up into a profitable position if he is an abstainer than if he is a drinker. Already many such establishments refuse to employ men who drink and there is reason to expect that more will do so.

5 Temperance is always advisable. This we may emphasize most strongly. But whether or not we shall teach the necessity or even the advisability of abstinence is another matter. About this the best men differ. Two who disagree may be

Errors in the current temperance teaching. Ethical considerations

The misstatements in the textbooks of the type referred to above are of various kinds. Sometimes the error consists in stating doubtful theories as attested facts; in other cases, the principles laid down are partly true and partly false; in still others, the statements are squarely opposed to the results of all of the latest and most accurate scientific research. The statements are enforced by quotations, of which some are by real authorities but are too often put in such ways as to misrepresent their actual teachings, while others are from men who do not stand for the best research and the highest scholarship but are quoted as the most reliable authorities.

I do not mean that the approved textbooks are all wrong. A great deal of what they say is entirely true. In the parts not bearing on the action of alcohol there is often little to criticize and much to commend. The trouble is this admixture of error.

In one respect they are all alike. The impression which they give the pupil is that science teaches that alcohol, even in moderate quantities, is always harmful and never useful. This is untrue.

The object is to oppose an enormous evil, to teach our youth to resist that evil. The purpose is most worthy; the trouble is in the method. The evil being clearly defined, a doctrine is formed to meet it, and evidence is sought to sustain the doctrine. Whatever can be found in its support is exaggerated. Whatever opposes it is ignored or denied. It gradually ceases to be the propagandism of the few and becomes the creed of the many. It is the old story of human dogma, repeated over and over again in politics, in theology, and in morals. And here, as in many other cases, the worthiness of the cause and the earnestness of the advocates are such as often to "deceive the very elect." Indeed, the very best people often become the most sincere and devoted advocates of the doctrine. In this case, the scientific expert is not deceived. But the statements are put in such persuasive ways and sustained by such seeming force of scientific authority that the unsuspecting pupil, and indeed the teacher who implicitly trusts the textbooks, is led to believe that they represent the real teaching of the best physiological science.[1]

I was once talking about this subject with a teacher and reminded her of Lincoln's saying: "You can fool all the people some of the time, and some of the people all the time, but you can't fool all the people all the time." She replied: "But can't we fool the boys till their characters are formed?" Now I think that lady was perfectly sincere; I am equally sure that she was wrong. You can not build character on falsehood.

A well known philanthropist in New York city tells this story: "I happened to be in a school down on the East side when a class of boys from tenement families were reciting in physiology. The teacher asked, 'What is beer?' The answer came in chorus, 'Beer is poison.' Now those little chaps knew that

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[1] An honored teacher whom you well know, Samuel T. Dutton, formerly of Brookline Mass., now of New York, in discussing this subject, speaks as follows:

> From the point of view of temperance, sound education and good morals, I am sure that this condition of affairs calls for our strong disapproval. We do not teach hygiene by the study of disease, cleanliness by the observation of filth, purity by the contemplation of vice; and to force upon every child 100 lessons or 500 lessons on the effects of alcohol is likely to take away his sensitiveness and to make him morbid or indifferent, if it does not bring about a reaction which leads him to say: "I am going to try it." Children who are taught that wine and tobacco are absolute poisons, and who see their fathers, brothers and friends constantly indulging in these stimulants, can only look with ridicule and contempt on this effort to deceive and frighten them. It is certain that the teachers who have tried conscientiously to give this instruction have often seriously questioned whether they are not justified in evading the requirements of the law in order to avoid the greater evils which were likely to follow the teaching.

I wish to emphasize what seems to me the unwisdom of this kind of teaching for young children, to which Mr Dutton has so aptly referred. It is argued that a great majority of the youth leave school early and the only opportunity to teach them anything about this most important subject is in the lower grades. Since they can be taught but very little, the instruction is confined mainly to one thing, namely, the principle that physiologic science shows that alcohol is always harmful to health. Even if this were true, it seems to me doubtful whether the teaching could have the desired effect, whether the harm that comes from the revealing of evil to children is not greater than the good. But, considering how much untruth there is in the doctrine, must it not in the long run be positively harmful?

that was a lie. Their fathers and mothers drank beer every day. Such children were not fooled by any such teaching."

But even if they are deceived for a time, it will not last, nor can you get around the difficulty by falling back on definitions. Tell a boy a thing is poison, and he will suppose that you mean by poison what he means by it, and what people generally mean by it. He has not access to the particular dictionary or scientific treatise which has a definition that may be stretched to fit your meaning. You may persuade him for a time that it is a poison in the popular sense of the word, but, when he grows up, he will learn that he was mistaught; indeed, he may do so before he is grown up. Scholars in the higher classes share the present tendency to skepticism; when the pupil finds that he was deceived, he does not mince matters, he reasons with himself, "That teacher and that textbook lied. If they would lie in one case, they would in another, and I am not going to believe anything they told me." Even if he does not go so far as this, even if his faith is not lost but is only shaken, the harm is done; the effect is to undo much of the good that the teaching is intended to do. Furthermore, and what is still worse, the result must be to impress on the pupil, and by the most effective agency, that of example, the example of the school, the Sunday school and even the pulpit, the idea that deception is allowable in a good cause, that the end justifies the means. This is undermining the very foundations of morality.

One of the most honored school superintendents in the United States remarked to me in speaking of this subject: "Teach the boy of 10 that a lie is the truth, and at 20 he is in danger of believing the truth is a lie."

This evil, so intrenched behind the earnest aspirations of our community, and so fortified by legislation, is the one against which I protest and which I urge you, as leaders in education, to unite in your endeavors to oppose.

Perhaps I ought to speak more considerately of things so dear to thousands of the best, the most earnest, the most devoted people, those to whom temperance means so much, who would shrink with horror from intentional deceit and in the fiber of whose noblest thought this doctrine is so interwoven. We meet here a very peculiar difficulty. The object of this teaching is a noble one. When we criticize the method, we are in danger of seeming to oppose the purpose, and yet the improvement in method is necessary for the attainment of that purpose. It seems to me that one of the great obstacles in the way of the true temperance reform is found in this very exaggeration which makes so large a part of the means used to promote that reform. It is building on the sand. The place to build is on the rock of attested truth.

You see then, that I am not trying to set up a dogma in opposition to "scientific temperance instruction." I earnestly approve of the purpose but object to part of the method. I protest against the dogmatic teaching of scientific theories which still lack demonstrative proof. More than that, I protest against the teaching of what science shows to be positively erroneous. And I also ask that the teaching of science in our schools shall keep pace with the progress of research.

But what are we to do about it? I hesitate to make positive suggestions to those who have much more experience than I and on whom rests so much of grave responsibility for deciding what instruction our youth shall receive. I venture, however, these considerations.

The success of such instruction depends very largely on its spirit. If it is based on the real desire for truth, if disputed principles are referred to as questions rather than demonstrated facts, if no more is claimed than is proved, and if, under these restrictions, the evils of alcohol are clearly set forth, and specially if the teacher speaks with the power of accurate knowledge and profound conviction, the instruction can not fail to be incalculably useful.

Still more effective will it be, in my judgment, if less stress is laid on the material, i. e., the physiologic and economic side of the question, and more on its moral aspects. Our people are keenly alive to ethical ideas. And youth is a time when thought is fresh, the aspiration is for the ideal, and mind and heart are open to the truest ethical impulses. Let me emphasize most strongly the moral aspects of this question. Temperance reform is moral reform. I can not see how a thoughtful man, earnestly desirous of rendering his best service to the community, can fail to be interested in that reform. The harm which alcohol does to health, the economic injury it brings to the individual and to the community are terrible enough, but it seems to me that the supreme evil which comes from its misuse is its effect on character, its power of demoralization, the moral ruin which it brings. No exaggeration is needed to paint this picture in the most terrible colors. As one who has been interested in temperance reform from childhood, I have come to believe that we have been depending too much on the economic and physiologic argument. Statistics of the nation's liquor bill do not appeal very strongly to the ordinary man, still less does the average boy care for them. The men who know most about the physiologic effects of alcohol are specialists in physiology and hygiene. I know scores of these men. Total abstainers among them are exceptions, I was about to say, rare exceptions. The same, we all know, is true of practising physicians. If they are not persuaded by the facts they know so well in both theory and practice, what can we expect from teaching the average boy or girl a little of the theory?

The supreme object of education is the formation of character. Character is shaped by education, but its basis is morality. Again I say, temperance reform is moral reform. The mind and heart of youth are most strongly influenced by mortal thoughts, by ethical ideals. There you can keep within the truth and there make the strongest appeals.

I am speaking to you as teachers, about a principle of pedagogics. Will it seem inappropriate if I refer to the example of the greatest of all teachers, One whose doctrine is so profoundly wise that its wisdom is the more highly appreciated as the individual and the race constantly increase in knowledge and experience? The foundation of His whole doctrine was simple truth. He appealed always and solely to what is best in us; least to the lower and more material considerations and most to the higher ethical aspirations. Above all things, He avoided the basing of rules for conduct on material arguments about which there could be any special doubt. That teaching is understood by the child, its power over him grows with his growth, it becomes a controlling force in his life. I do not say that material arguments can not be effective, nor do I wish to minimize their usefulness. What I do urge is that they can not be useful at all unless they are so true as to be beyond question, and that, at best, they do not constitute the most effective appeal. Tell the child that the reason why he should not drink is because alcohol is always poisonous, enlarge on the harm it does to health, and you may produce a strong impression, but the danger is that it will not be lasting. The seed falls where there is not depth of earth; and, with the on-coming of mature knowledge and the understanding that the principle is wrong, it withers away. Plant where there is depth of earth, where the roots will strike down into the depths of moral conviction, and it will bear fruit many fold.

Those things are most influential and useful in education which draw out what is best in the learner, which cultivate the germs of conviction and aspiration in his own soul, so that they grow up into purpose, character and influence. What we say, the child forgets. The rules are written on the memory, but time effaces them. The things which remain are the impressions which sink down, become a part of feeling and judgment and then grow up again into permanent character. The impressions that are lasting and useful are the ones that accord with the deepest and truest convictions, and the ones that the experience of age can verify. These are what develop the power within us that makes for righteousness.

One essential for the success of true temperance reform is that what is taught as science shall be placed on the basis of demonstrated fact. This means a change of base on the part of a great body of our most earnest temperance reformers; but that change is necessary. We wish to help the drunkard to reform; but is it necessary to tell him that no man can touch alcohol without danger? To build up the public sentiment on which the reform of the future must depend, we wish our children to understand about alcohol and its terrible effects; but, when we teach them in the name of science, shall we not teach them the simple facts which science attests and which they can hereafter believe, rather than exaggerated theories, whose errors, when they learn them, will tend to undo the good we strive to do? In short, is not temperance advisable even in the teaching of temperance doctrine?

In the great effort to make man better, there is one thing that we must always seek; one thing we need never fear—the truth.

Conclusion as to alcohol physiology in the schools and legislation requiring it

To come back to the original question: my own answer will be somewhat like this.

The amount of time and space that should be given to the physiologic action of alcohol in our school books and schools should be limited. I should say that a small number of pages, enough to correspond to only a very few daily lessons, would be ample, and that this should be taught only in the higher and not in the lower grades.

The kind of instruction should be that which is scientifically correct. Above all it should be based on plain, well attested, impartial, unexaggerated fact. The chief argument against the use of alcohol should rest on the ethical rather than on the physiologic or economic basis.

The legislation which requires this instruction should be general rather than specific. Both the kind and the amount of instruction should be left to the great body of capable, conservative, and earnest educators to decide.

troduced in the legislature and warmly urged. Some of the achers, indeed, felt that it would be better to do away with ll legal requirements for temperance instruction, but they with- eld opposition as did many of the temperance people, who felt at the new bill surrendered what they had earnestly and con- ientiously striven for. A few of the more strongly partizan emperance people in the state objected to it. The strongest pposition, however, and it was at once viligant, systematic and tense, came from the national organization of the Woman's hristian Temperance Union through its department of scien- ific temperance instruction. On the other hand, the bill was armly approved by such educators as Pres. Hadley of Yale, res. Raymond of Wesleyan and a number of the scientific men f the state. When the bill came to actual vote in the legisla- ure, it passed without a word of opposition.

An incident in the campaign is worthy of mention. It arose rom the division in the ranks of the Woman's Christian Tem- erance Union. The state branch had pledged itself to the upport of the bill. The national organization endeavored to nduce individual members and organizations in the state to ithdraw their support and oppose it. The state president, owever, was true to the pledge and was able to influence most f her associates in the state to be true also.

Indeed, it was evident to the temperance people that this as the part of wisdom. They saw the danger that all they ad accomplished by way of legislation would be done away with. hey had also learned that not even state legislation could be epended on to enforce instruction which was opposed to the eason and conscience of the teachers and the best pedagogic nd scientific opinion.

The new law is a compromise. While it does away with much hat the temperance people earnestly desired, it still goes fur- her in its requirements than many of the teachers would have ished. But it has the great advantage that it leaves the char- cter and amount of instruction in alcohol physiology to the ood judgment of the teacher. It requires that (1) the effects of alcohol and narcotics on health and specially on character shall be taught in connection with hygiene as a regular branch of study to all pupils above the third grade, except in public high schools, that (2) suitable textbooks of physiology and hygiene, which explain the effects of alcohol and narcotics on the human system, shall be used in grades above the fifth, except in public high schools, and that (3) all normal schools and teachers training classes shall give instruction in this subject and in the best methods of teaching it. It does away with the old requirement for teaching it below the fourth grade, because of the belief that little children are better off without it. It does away with the requirement for teaching it in the high schools, on the theory that physiology should be taught there like other branches of science. It leaves the kind and amount of teaching, as well as the kind of textbook and the amount of alcohol physiology it shall contain, to the decision of school boards and teachers, on the supposition that they can best judge what will be most useful to be taught to the children in their charge.

The chairman of the teachers' committee, W. B. Ferguson of Middletown, says very aptly that this is the first instance on record of the temperance people and teachers of any state uniting in the support of a measure of this kind. He adds:

> Too much praise can not be given those broad-minded, sensible, and courageous temperance people of Connecticut who showed an open mindedness, a spirit of conciliation, an invincible loyalty to their agreement under circumstances that would have severely tested the courage and faithfulness of any but those who place duty before policy, honor before favor, and the interests of the children before the pleasure or censure of anybody.
>
> It now remains for the school officials and teachers of the state to live up to the letter and spirit of the law by endeavoring to impress on their children and youth the principles of temperance and of temperate living.

Our act of 1893, which this new one of 1901 replaces, was less stringent, less burdensome to teachers, and, in my judgment, less detrimental to the interests of the schools and of temperance than your present legislation in New York. In our case the change was rendered possible by a discussion in which the public was made aware of the actual nature and tendency of the law and of the instruction it required, and of the attitude of teachers and others regarding it. The conflict between the so called "scientific temperance instruction" and the convictions of educators and men of science was thus made clear. The more conservative temperance leaders met the teachers half way. Thus united, they took counsel with each other and with educational and scientific authorities, agreed on a measure, saw it through the legislature despite the opposition of the more radical elements, and are determined to do their best to make the teaching effective for the purpose for which it is really intended. This seems to me a very happy solution of what otherwise might have been a very serious difficulty.

I venture to inquire whether you may not be able to bring about a similar cooperation of conservative friends of temperance reform in your own state.

[Prof. Atwater referred to a statement quoted by the committee from Steele's *Hygienic Physiology* as an illustration of the teaching that alcohol is not oxidized in the body and, on this account, can not serve for nourishment. He stated that this passage occurs in the latest edition he had been able to obtain from the publishers, one or two years ago, and that it contained an indorsement by the scientific department of the Woman's Christian Temperance Union, certifying that the statements in the book had been carefully revised so as to keep abreast with the latest teachings of science. This statement was, according to his recollection, dated in 1889. As Mrs Hunt, the superintendent of the scientific department referred to, was present, he asked that she would kindly correct his statement if it was in any respect erroneous. Mrs Hunt replied as follows:]

Mrs Mary H. Hunt—*Mr Chairman:* I understand Prof. Atwater to charge that the *Hygienic Physiology* by J. Dorman Steele, was not abreast with the teachings of science on the subject of the oxidation of alcohol in the human body at the time indorsement to it was given.

as evidence of the inaccuracy of the teaching for which the temperance education movement is responsible.

[The textbook referred to is Steele's *Hygienic Physiology*, which bears the following indorsement:

Boston, June 20, 1889

The Pathfinder Series of Textbooks on Anatomy, Physiology and Hygiene consists of the following volumes:

1 Child's Health Primer (for primary grades)
2 Hygiene for Young People;
  or Young People's Physiology (for intermediate classes)
3 Hygienic Physiology (for advanced pupils)

The above are the series originally prepared (as their general title indicates) to supply the demand created by the laws for temperance instruction in public schools in the United States. They were written by experts under the supervision of the scientific department of the National Woman's Christian Temperance Union, published by the instigation of the same, and have been carefully revised from time to time, under the same supervision, to keep them abreast with the latest teachings of science.

Being both teachable and well adapted to grade, their educational value, as proven by school room tests, is of the highest order. We therefore cordially indorse and highly recommend the Pathfinder Series for use in schools.

Mary H. Hunt
National and international superintendent of the scientific dep't of the Woman's Christian Temperance Union; life director of the National Educational Association

Advisory board

Joseph Cook   William E. Sheldon
Albert H. Plumb D. D.   Daniel Dorchester D. D.

In the *School Physiology Journal*, edited by Mrs Hunt, several series of approved physiologies have long been advertised. The Pathfinder Series, to which Steele's *Hygienic Physiology* belongs, was placed first in the list of those recommended in the advertisement as late as September 1900. In October 1900 the New Century Series was announced, but the Pathfinder Series was still continued, though it does not appear in the latest numbers of that journal.

The passage referred to by Prof. Atwater was the following from pages 177-79 of the textbook named:

Is alcohol a food? To answer this question, let us make a comparison. If you receive into your stomach a piece of bread or beef, nature welcomes its presence. The juices of the system at once take hold of it, dissolve it, and transform it for the uses of the body. A million tiny fingers (lacteals and veins) reach out to grasp it, work it over, and carry it into the circulation. The blood bears it onward wherever it is needed to mend or to build "the house you live in." Soon, it is no longer bread or beef; it is flesh on your arm; its chemical energy is imparted to you, and it becomes your strength.

If, on the other hand, you take into your stomach a little alcohol, it receives no such welcome. Nature treats it as a poison, and seeks to rid herself of the intruder as soon as possible. The juices of the system will flow from every pore to dilute and weaken it, and to prevent its shriveling up the delicate membranes with which it comes in contact. The veins will take it up and bear it rapidly through the system. Every organ of elimination, all the scavengers of the body—the lungs, the kidneys, the perspiration glands, at once set to work to throw off the enemy. So surely is this the case, that the breath of a person who has drunk only a single glass of the lightest beer will betray the fact.

The alcohol thus eliminated is entirely unchanged. Nature apparently makes no effort to appropriate it. It courses everywhere through the circulation, and into the great organs, with all its properties unmodified.

Alcohol, then, is not, like bread or beef, taken hold of, broken up by the mysterious process of digestion, and used by the body. "It can not therefore be regarded as an aliment", or food. *Flint*

To the above clear statement that the alcohol, instead of being burned in the body, is eliminated without change, is added the following statement in a footnote, which represents the oxidation of alcohol as a disproved theory.

Because of the difficulties of such an experiment, we have not yet been able to account satisfactorily by the excretions for all the alcohol taken into the stomach. This remains as yet one of the unsolved problems of physiological chemistry. To collect the whole of the insensible perspiration, for example, is well-nigh impossible. It was supposed at one time that a part of the alcohol is oxidized—i. e., burned, in the system. But such a process would impart heat, and it is now proved that alcohol cools, instead of warms, the blood. Moreover, the closest analysis fails to detect in the circulation any trace of the products of alcoholic combustion, such as aldehydes and acetic acid. "The fact", says Flint, "that alcohol is always eliminated, even when drunk in minute quantity, and that its elimination continues for a considerable time, gradually diminishing, renders it probable that all that is taken into the body is removed."

[Referring to the above statement Prof. Atwater said:]

The difficulty of collecting the whole of the bodily excreta, including the "insensible perspiration" was solved by Pettenkofer and Voit with the respiration apparatus as early as 1862. In 1883 Bodländer measured the alcohol excreted by a dog through the lungs, the skin and the kidneys separately and found that under ordinary circumstances, at least 95% was oxidized in the body.

To recapitulate briefly: The theory that alcohol is not oxidized but is eliminated entirely unchanged was proposed by Lallemand Perrin and Duroy in 1860 on the basis of experiments which were soon afterwards shown to warrant no such conclusion. Other experiments before and after 1860 showed that alcohol is oxidized. No prominent experimenter on the subject since 1870 has claimed anything else. The question was practically closed by 1875, and in 1883, accurate measurements by Bodländer showed that only very small quantities are given off unoxidized. The textbook states clearly that alcohol is eliminated without oxidation and makes this the basis of the claim that it can not serve the body as food. The indorsement in 1889 states that the textbooks of this series were written under the supervision of the scientific department of the Woman's Christian Temperance Union, published by its instigation, and had been "carefully revised from time to time to keep them abreast with the latest teachings of science." In 1900, this series, still bearing the same indorsement, was placed first in the list of the textbooks recommended in advertisements in a journal published by Mrs Hunt.

[Comparison of recent editions of Steele's *Hygienic Physiology* shows that, while a number of changes were made throughout the book in 1897, the revision of pages 177-79 was not made till 1900. *Note by Franklin W. Barrows, president of the association*]

Dr Didama—I have just a few words to say, and it will not take me any great length of time. There has been some discussion about the kind of books which are used in teaching temperance in the schools as the law requires. There have been some objections to the books which have been used, and some new ones, entitled the *New Century Physiologies*, have lately been prepared by Dr Henry F. Hewes, the eminent teacher of physiologic and clinical chemistry in Harvard Medical College, and by Dr Hall, professor of physiology in Northwestern University. I have looked them over with some care within two or three days, and I think I can commend them as being quite free from the faults of the old books. Now whether alcohol is a food, as Prof. Atwater claims to have demonstrated—and I think many will go away from here satisfied that he did demonstrate it—or a poison with little food value, as is claimed by many of the most eminent physiologists, I earnestly protest against teaching children in our schools that alcoholic beverages taken in moderation are beneficial rather than injurious. Moderation is a word of dangerous use. Every criminal convicted of deeds committed when intoxicated, every one who died a drunkard was at one time a moderate drinker. Most of you know that more than $700,000,000 are expended in this country every year for alcoholic beverages, and that another $700,000,000 are required to punish the criminals and support the paupers who were made criminals and paupers by the use of these drinks. Years ago alcohol in the form of beer or whisky was thought to be necessary for laborers in hot weather, and specially in the cold of winter. In harvest time farmers used to lay in a large supply of whisky, because hired men would not work unless they could have their drinks regularly. It was generally believed in those days and is still believed by some people that a drink of whisky is good if exhausted or fatigued and excellent to improve the digestion. You all know the testimony of arctic explorers like Kane and Nansen, that men undergo cold better without alcohol, and Kane never administered any even when the thermometer went down to 80° below zero. Lord Kitchener, who was the commander in chief of the English army in Egypt, declared that his soldiers bore the fatigue of long marches and were better fighters and recovered sooner from exhaustion when they did not have alcoholic drinks, and they never had a drop of grog in all that long campaign. Kitchener knew that the dervishes were the best fighters in the world, and that, being

Mohammedans, they never used intoxicants, for this was forbidden by the Koran. Col. Ray, commandant of Fort Snelling, in Minnesota, informs me that beer-drinkers were the first to fall out in long marches and the most inaccurate marksmen that he had, when he needed good marksmen with these modern guns which carry to a long distance.

I want to ask this question: How many parents would like to have their children taught that alcohol taken in moderation is harmless, when, if it were known that these children used it, they would be excluded from employment in most kinds of business, from being a captain on a steamer, an engineer on a railroad, or any position of trust or responsibility? How many parents would dare to run the risk that their children might become inebriates and criminals from their personal use of this highly commended whisky food?

O. D. Clark—We have with us this afternoon a lady who has been most intimately connected with this movement of reform in the teaching of the effects of alcohol and narcotics; and I am sure we should all be delighted to hear what she has to say, and I think I represent the association in asking that the chairman do not enforce the five minute rule.

Mrs Mary H. Hunt—I agree most heartily with Prof. Atwater that we need not be afraid of truth. But the great question before us is, what is truth? I understand Prof. Atwater to say that the temperance teaching in the public schools is not in accord with the views of specialists and the latest scientific investigations and therefore is not true. In proof of this he cites his own experiments. The impression left on my mind and, I think, on the audience, is that he claims that Dr Rosemann, of Griefswald, sustains his (Prof. Atwater's) deductions from his Middletown experiments to the effect that these experiments proved that alcohol protects the albumen of the body of the drinker and therefore has food value as a beverage.

I, too, have been studying Dr Rosemann's 200 page article in Pflüger's *Archivs für Physiologie*. I regret that Prof. Atwater failed to give Dr Rosemann's conclusions drawn from his experiments, for those conclusions put the whole matter in a very different light from that just presented to us. I happen to have with me a translation of the summing up of the whole matter which Rosemann makes in his paper. He sweeps the beverage use of alcohol aside with these words: " It is generally agreed that alcohol can play no rôle as a nutriment in health. The only question, therefore, is concerning the employment of alcohol as a food with the sick "; and then there are grave doubts, and only experiments can give the final decision.

Dr Rosemann's experiments show that during the first four to six days when alcohol was taken there was a loss of albumen. This Rosemann takes into account in considering the advisability of using it as a food in sickness. He says: " If we were certain that an increased albumen loss would be easily endured by any patient for from four to six days, we might then obtain in alcohol, for the later period, an easily ingested albumen-sparing substance."

But he further says:

> I hold it quite possible that there are entirely healthy men whose cells do not become accustomed to the injurious effects of alcohol upon albumen, or at least only slowly and eventually not in full measure. If, therefore, under normal conditions the albumen-sparing action of alcohol does not always finally take place in the person in health, the result with the sick is to me still more doubtful. In any case, one can not without further evidence take it for granted that the cells of the sick will become accustomed to alcohol at the same rate as those of the well.

Hence, according to Rosemann, no one can foretell in any given case first, whether the body cells of the sick or well will ever become so accustomed to the injurious effects of alcohol that it will cause a sparing of albumen; and second, whether, in the case of the sick, the loss of albumen caused by alcohol during the time the body is trying to get used to it will not kill the patient.

It is a matter of public knowledge that Prof. Atwater announced to the world as one evidence of the food value of alcohol that he had proved that it protects the material of the body from consumption as effectively as corresponding amounts of sugar, starch and fat; but it is likewise known that the published tables of his experiments do not support this conclusion, hence his conclusion has been discredited by the scientific world.

Dr Rosemann reviews the Atwater experiments in the article in question and says distinctly that they did *not* show a protection of protein, but on the contrary a very significant loss. Hence, we are unable to see how this statement of Rosemann accords with the claims made by Prof. Atwater for his experiments.

Furthermore, quantities of alcohol smaller than those given in the experiments to test its food value derange the nervous system to such an extent that the working ability of brain and muscle is diminished; hence from any rational standpoint alcohol can not be considered a food in the sense in which the word food is commonly used, i. e. as a substance whose nature it is to build tissue and furnish energy to the body without injuring any of its parts.

In referring to the report of the science committee, please allow me to disabuse your minds of one fallacy that seems to be afloat. The temperance education laws say, "the nature of alcoholic drinks and other narcotics and their effects upon the human system in connection with the several divisions of physiology and hygiene shall be taught all pupils in all schools," but there is not a line nor a word in the temperance education law of this or any of the other 44 states in this country or in the national law that specifies what shall be taught about alcohol or other narcotics. If this science committee can prove Dr Didama and all the doctors wrong and that alcohol is a food and not a poison, the school books will ultimately so teach, for truth can not be suppressed in this 20th century.

The argument of your committee's report that the oxidation of alcohol in the body proves it a food falls before the fact that other poisons as morphia, etc., are oxidized in the body, producing heat and energy, but that does not make them foods.

It is most fortunate that this committee proposes to continue its study for another year. Over against its quotations from Fothergill, who died 13 years ago, we suggest that they study the 2000 experiments recently performed in the laboratory of Prof. Kraepelin in Heidelberg, and others that show the absurdity of asserting that the nature or character of a substance changes with its quantity. Dr Koppe put this strongly before the International Medical Congress at Moscow, in 1897. He said:

> The chemical nature of a substance can not change with the quantity, and can not be lost in the smallest quantity; but it must in every qualitative analysis remain the same so long as by progressive division this substance as such still exists, even down to the last molecule.

An essential, more than that, a vital truth has been left out of the committee's plea for moderate drinking, namely, the fact nobody can deny that a little alcohol has the power to create an uncontrollable and destructive appetite for more.

The English definition of a poison which Prof. Atwater gave does not fit the case. I know of no other definition of a poison as "a substance that can only do harm and never good to the body." Dr Didama will tell you that he sometimes gives his patients preparations of arsenic for medicinal purposes, that is, to do good to the body, but this does not make arsenic any the less a poison. Poisons are not substances that always do harm and never do good. The definitions of poisons in the school physiologies are in accordance with the definitions of great authorities like Taylor. In his standard book on poisons he says, "A poison is a substance whose nature it is when absorbed into the blood to injure health and destroy life." Education begins with first principles which lead on to larger developments of truth. If you are going to wait till children can understand all about any subject before you teach them anything, you may as well shut up your schools at once.

As to the complaint that there is too much temperance matter in the textbooks: if every detail of the question of the effects of alcohol on the human system were treated, one fifth of the space of the books would not be enough to cover it, but that is not done. The amount of physiology and general hygiene that is needed in each successive grade of the school course is first computed, and then the proportion of temperance matter required for a clear statement of the facts that the pupils should know. From this we get the proportion of four fifths general physiology and hygiene and one fifth temperance matter.

I regret that there is not time to show you that the Connecticut temperance education law which has been recommended to you as a substitute for your admirable statute on this subject is only words, words, sounding brass and tinkling cymbal.

Prof. Bishop—I would like to ask one question for information. You said that certain poisons are oxidized in the body. On what experimental evidence is that statement made?

Mrs Hunt—I can give you the authority of such men as Dr Hall, a graduate of Leipzig, Dr August Forel and Dr Hewes.

Prof. Bishop—I have seen the statements, but I did not find that they were backed by any experimental proof or any evidence whatever.

Mrs Hunt—That can easily be furnished and I will be very happy to furnish it, but I shall have to refer to my library to do it.

Mrs Hunt—[Given later in answer to the above question] Experimental evidence that morphia, a poison, is oxidized in the body will be found in an article by Edwin S. Faust, in *Arch. für Experimental Path.*, 1900, v. 44. Wood's *Therapeutics*, edition of 1897, p. 677, cites the original works of authorities who have shown that carbolic acid is oxidized in the body.

Prof. Burt G. Wilder—I am satisfied that the last speaker and her coworkers, like Prof. Atwater and our committee, are all seeking the same good end, the welfare of the race. We differ, as has been said, as to the soundness of certain doctrines and as to the desirability of certain subordinate aims and methods. Unfortunately these differences are radical. But I trust the report of our committee, so far as it goes, may be accepted as a deliberate and conscientious expression of our present views. The improbability of any material change in my own opinions may be inferred from the fact that they are now substantially what they have been for a third of a century. As a youth the subject gave me no concern. My parents were not total abstainers, but their four boys neither smoked nor drank, even beer, and I served through the civil war without once tasting whisky. But when, in 1868, I came to address the first freshman class at Cornell University on physiology and hygiene, I was compelled to decide what should be said to them, not merely as youths of that date but as future men and leaders in the community. And so, as if I had been their elder brother or their parent, I set myself prayerfully to ascertain what was the truth in this matter. I reached a certain conclusion, and that conclusion has not changed materially from that time to this. All that has been said, all that has been written, all the experiments that have been performed, all the arguments one way or the other, have not materially changed the opinion which I expressed then, which was practically embodied in the report of our committee today, and which I predict, though I may not live to see it, will be the prevailing opinion of the future, namely, that youths should avoid alcohol in every shape, for plenty of reasons; but that the average adult, who has not inherited a special tendency to be affected by alcohol, who is in ordinary health, under ordinary conditions, may use a certain limited amount, at meals only, and at the end of the day's work; furthermore, that all, even children, should be taught that this is the true doctrine. Personally, also, whatever freedom is permitted with respect to fermented beverages, wine or beer, I wish it were impossible to obtain at a saloon any distilled liquor to be drunk on the premises. One serious difficulty has yet to be overcome, viz, the inadequacy of the definitions of the terms that are employed in discussing this question. We have struggled with them and we are still at work. In particular, the phrase "moderate drinker," is evidently used in very different senses. With some it designates a person who is in peril himself and likely to harm others. But at a meeting called by advocates of "No License," the president of Harvard University declared himself to be a "moderate drinker, that is, not a total abstainer, but using alcohol in moderation."

Mrs Ella A. Boole—The organization I have the honor to represent, the Woman's Christian Temperance Union of the State of New York, has a membership of more than 22,000, and a following of 30,000, so that I am safe in saying that I represent 25,000 mothers. These women are vitally interested in the training of their children, and, if I had a boy, I should have been sorry to have him hear what seemed like a plea here this afternoon for moderate drinking.

A student from Cornell, on being warned by his mother against drinking, replied, "Mother, it has been proved that it will not hurt a fellow to drink a little liquor. Prof. Atwater says so, and he is a college professor." I do not believe that Prof. Atwater wants to be quoted by college students as approving moderate drinking, but, because he is a college professor, because he insists that alcohol is not a poison, even though he says that boys under 21 should not touch it, they will construe it as safe for them to take an occasional glass, and such teaching is dangerous.

It is charged that some children have received incorrect impressions; but as an old-time teacher with some years of experience, I always used to think that this result was a reflection on the teacher.

If this has been the result of some of the teaching of physiology and hygiene with special reference to the effects of alcoholics and narcotics, it certainly is a reflection on the teachers, that they have not presented the subject in such a way that it could be comprehended by the pupils; and I believe the fault lies in the fact that methods of teaching have not been presented in the normal schools and teachers institutes in such a way as to impress the teachers that the object of this instruction is to make of the boys and girls intelligent total abstainers from liquor and tobacco.

Another point. I do not believe that the investigation undertaken by this committee has been entirely fair. They have meant it to be so. But, as the inquiries sent out went mainly to male teachers, some of whom may be biased in their views because they themselves use tobacco, to make the investigation perfectly fair, questions should have been sent to an equal number of men and women teachers, for there are many that believe in the law.

There is another class of people that ought to be consulted, and that is the mothers of the state. We women have something more than money invested in the boys and girls of the state, and we want them taught the truth in our public schools in such a way that it will make them intelligent total abstainers from liquor and tobacco. I could bring you the testimony of mothers who tell about the boys coming home from school, and telling of the bad effects of alcohol. I could tell you of the Wayside Home in Brooklyn, where years ago the girls used to come, and say they did not know that beer would make them drunk, and they took it innocently. There is scarcely a girl who comes there now who says that, because the children are taught in the schools that the alcohol in the beer, wine and whisky is a poison, and that, taken in small quantities, it has the power to create the appetite for more. This instruction is bearing fruit and that to the saving of our boys and girls from strong drink.

Another thought. I should be very sorry to have this meeting this afternoon reported in the newspapers. You may not look at it in the way I do; but the liquor interests are all too ready to spread such thoughts abroad, and they will construe this report as presented here this afternoon as an indorsement of moderate drinking, and even they believe in that.

We as mothers must insist that the youth of the United States must be taught that the danger is in the first glass of alcoholic liquor, and that it is never safe for man, woman or child to consider that there is no danger in taking liquor occasionally.

It was said this afternoon that no law was ever obtained by the united efforts of the temperance forces and the teachers except the Connecticut law. I happened to be a state officer at the time the present law was obtained here in New York state, and was present at a conference in New York city where were present Sup't Skinner and a number of prominent teachers of the state, and where we agreed on some of the provisions of the present law. We conceded some things at that time that there might be harmonious relations between the teachers of the state and the Woman's Christian Temperance Union, for both are and ought to be vitally interested in the welfare of our future citizens.

Prof. Brigham—It seems to me that we are in danger of losing sight as an association of the report which has been presented to us. It is well that we should bear that in mind. I am sure it must be right for us to consider, and through the medium of a competent committee to investigate the question of fact, the question of pedagogy and the question of morals involved. It must be right and useful for us to have such a report presented as has been presented, and it must be safe that such a report should have publicity. Have we duly considered the spirit of this report? Have we considered the amount of patient investigation, the anxiety and labor which have gone into it? The presumption seems to be from the reading of that report that something is wrong with the teaching about alcohol. We are not here to decide on the fact, helpful as the statements of Prof. Atwater and others have been to us. We are here to be sure that we are in the way of finding out the facts and the ultimate principles on which we should act; and I think that all present, though divided on certain matters, should agree that the report is admirable; that there is reasonable presumption from what has been said by so many teachers in New York State that something is wrong with the teaching; that, if we are not teaching error, we are doing what is almost as bad, we are teaching truth in an exaggerated way, and I am principally concerned for the assurance which I desire to have that this committee is to continue its labors and be able to bring us some further light a year hence. I am sure you will all agree that the teaching of error never has been, and never can, under any circumstances, be good. There is no time now to discuss the effects on the teacher, or the effects on the pupil, of teaching even the truth in the way of overstatement; that is sure to work harm. I want to remind the association that, vitally interested as we all are in the problems of temperance, we are not here and now concerned with measures of temperance. We are concerned with finding out what is true on this particular question and how we shall present that truth to the children of the schools. And so I do not at all share the apprehensions of the last speaker, though I sympathize with her earnestness, as to the harm that is going to come from publicity, for "Truth is a good swimmer" and will gain the shore.

Mrs Graham—The circulars sent out from this committee on stimulants and narcotics naturally came into my hands. These circulars were read and discussed at the annual convention of the Woman's Christian Temperance Union of Onondaga county. Resolutions were passed at that convention and resolutions have been passed by both state and national conventions protesting very strongly against any movement to repeal the law of scientific temperance instruction in the schools. A committee to reply to these circulars was appointed by this convention, of which I have the honor to be the secretary. The replies were based on the consensus of the acknowledged authorities on the subjects touched on in the circulars. As soon as it was known in the state that there was a movement on foot to modify or repeal the scientific temperance instruction law, petitions began pouring in on me. I hold in my hand petitions which represent thousands and thousands of the women of this state. And petitions have come not only from the women but from the men, from every walk in life, from the mother in the home and from the teacher in the high school and college, from the leader of the primary department of the state Sunday school association, from a life insurance agency as well as from superintendents of homes for fallen women and unprotected girls, all protesting against any repeal or any modification of the present law, stating that they knew definitely, being the teachers of children, or men who have examined and investigated the habits of men for the purposes of insurance and see the necessity for greater enforcement, and a more intelligent and sympathetic treatment of the law and its teachings. All these come to me as protests from those who know the effects of the teaching on the present generation of children, and on all interests in the business and social world. I would like to read just one or two of these:

To the committee on stimulants and narcotics: "In behalf of the 1000 members of the Ulster county Woman's Christian Temperance Union, I earnestly urge the enforcement of the temperance education law," etc.

It seems to me that the one remedy which we need is not a change in the law, for the law wisely recognizes the great strides which science is making today, and says that "the *nature* of alcoholic drinks and other narcotics and their effects on the human system shall be taught in connection with the various divisions of physiology and hygiene, etc.,"[1] leaving to the findings of world-recognized scientific and medical men and bodies to declare what this *nature* is. Textbooks embodying these findings are written by experts along these lines. Not a change in the law, I repeat, but a greater knowledge on the part of the teacher. I too have been a teacher, and I know with what the teacher has to contend. I know the many duties that are hers, and I know too that, whenever a teacher has a wider and fuller knowledge of the subject which she has to teach, that subject takes on a new life and interest in her soul which must be and is felt by those under her instruction. Did you go on to the high school and college with a great love for mathematics? Did you make the greatest progress in that line of work? Then you must have had an enthusiastic teacher and an intelligent teacher, for that depends on truth alone. It is the truth that we are after, and, in all honor to the last speaker, I must say that what has been said this afternoon has a very close relation to the question at hand as represented by the committee, because the committee would have it taught that alcohol is not a poison. It is the truth we seek for ourselves and the children, and changing the state law of scientific temperance instruction will not help, but will positively hinder its being found. What we need is the hearty cooperation of teacher and temperance worker at the institutes and teachers meetings. If once in a while one of these meetings could be devoted to the instruction of teachers along temperance lines, by an expert, some one who by his life and experience or his professional studies or practice, has become an expert in that line—if such a one could be brought into contact with the teachers, do you not think there would be a better understanding of this subject and a more united and sympathetic working together for the child's highest good and that of the nation? For "Education is not a *preparation* for life, education *is* life."

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[1] Ainsworth. School Physiology Law, with the amendments of 1896, section 1, § 19.

Prof. Frank Carney—As a member of this association, I move the acceptance of this partial report of the committee on stimulants and narcotics, and also that the committee be continued.

Prof. R. E. Dodge—I second that motion. I feel that it must be extremely discouraging for a committee to work for four years to make a fair report and go away feeling that they have not received the support of the association. It seems to me that this report is the most scholarly, the most careful, the most conservative which has been presented before this association in the years that I have attended the meetings; and I think we ought to support Prof. Bishop and his colleagues in their statements that children should abstain, that they should be taught habits of self-denial, and that we must leave it to the adult to decide what he is going to do along this line.

[The report of the committee was accepted as a report of progress and the committee asked to continue its investigations.]

Mrs Martha M. Allen—I simply wished to say that the medical journals have contained many articles in opposition to Prof. Atwater's conclusions. While these articles admit that Prof. Atwater's experiments settle what was heretofore disputed, that alcohol is oxidized in the body, they declare that too much has been claimed as proved by the experiments; that it has not been proved that alcohol is a food. These writers show from Prof. Atwater's own published figures that he is in error in some of his main conclusions as presented here today.

Those physiologists who teach that alcohol is a poison experimented on animals, and afterward killed the animals, thus obtaining evidence of poisonous effects. Prof. Atwater is not a physiologist; he is a chemist. His experiments were on a man, hence he could not kill his animal to know the effects of alcohol on the tissues. His experiments were very limited.

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